THE

GREAT EXHIBITION

ILLUSTRATED

1851

Engraved by T. Hollis, from a Daguerreotype.

REBECCA

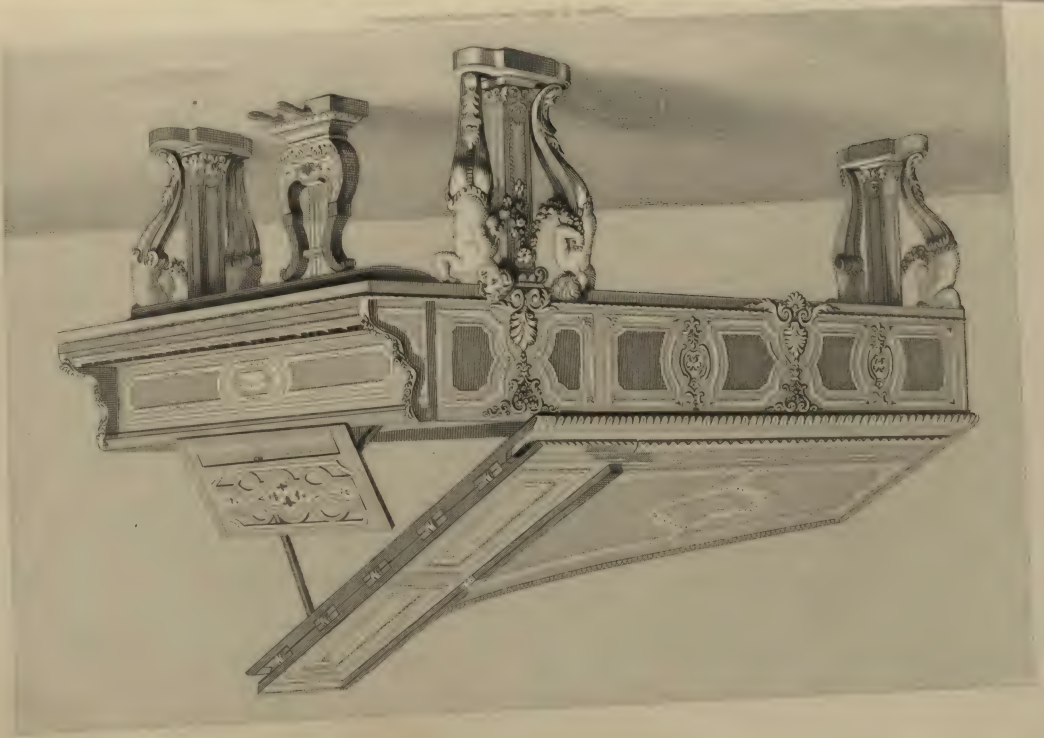
FROM THE ORIGINAL BY W. THEED.

THE MADONNA.

FROM THE ORIGINAL IN MARBLE BY P. VAN LINDEN

CALIFORNIAN GILT TEA SERVICE

BROADWOODS GRAND PIANO



Engraved by [illegible] from a Drawing by [illegible]

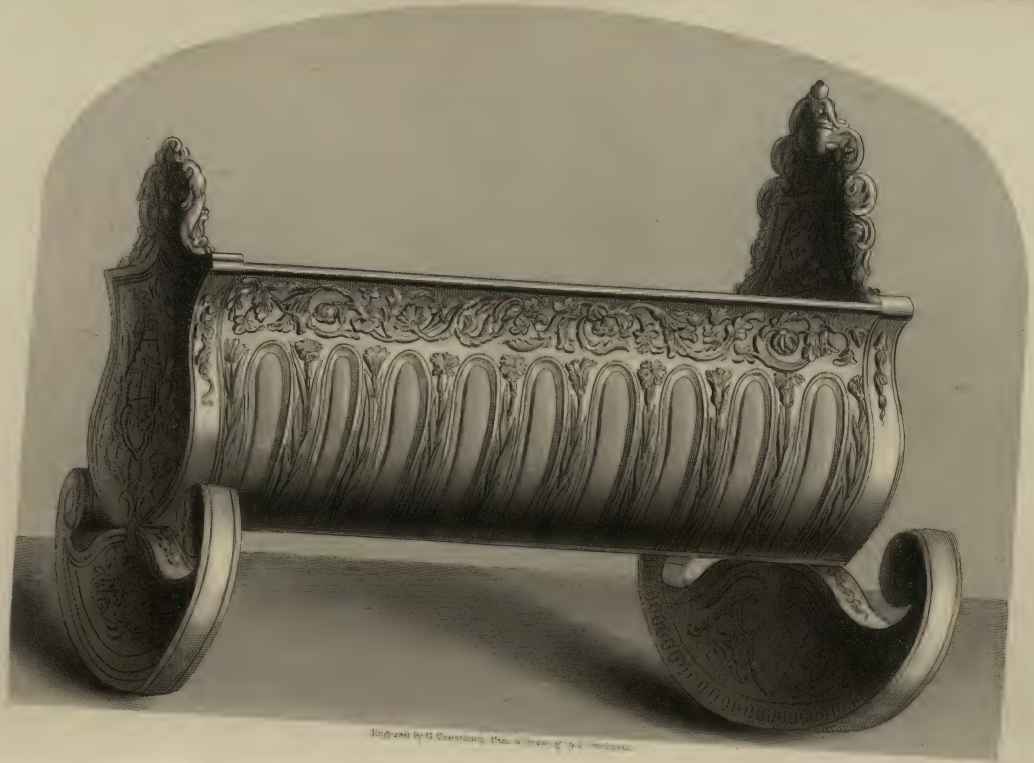
THE WARWICK PLATE.

EXHIBITED BY MESSRS. ELKINGTON

Large vase 3ft 6 in. high. From a Drawing by J. H. W.....

THE CONYER'S TESTIMONIAL

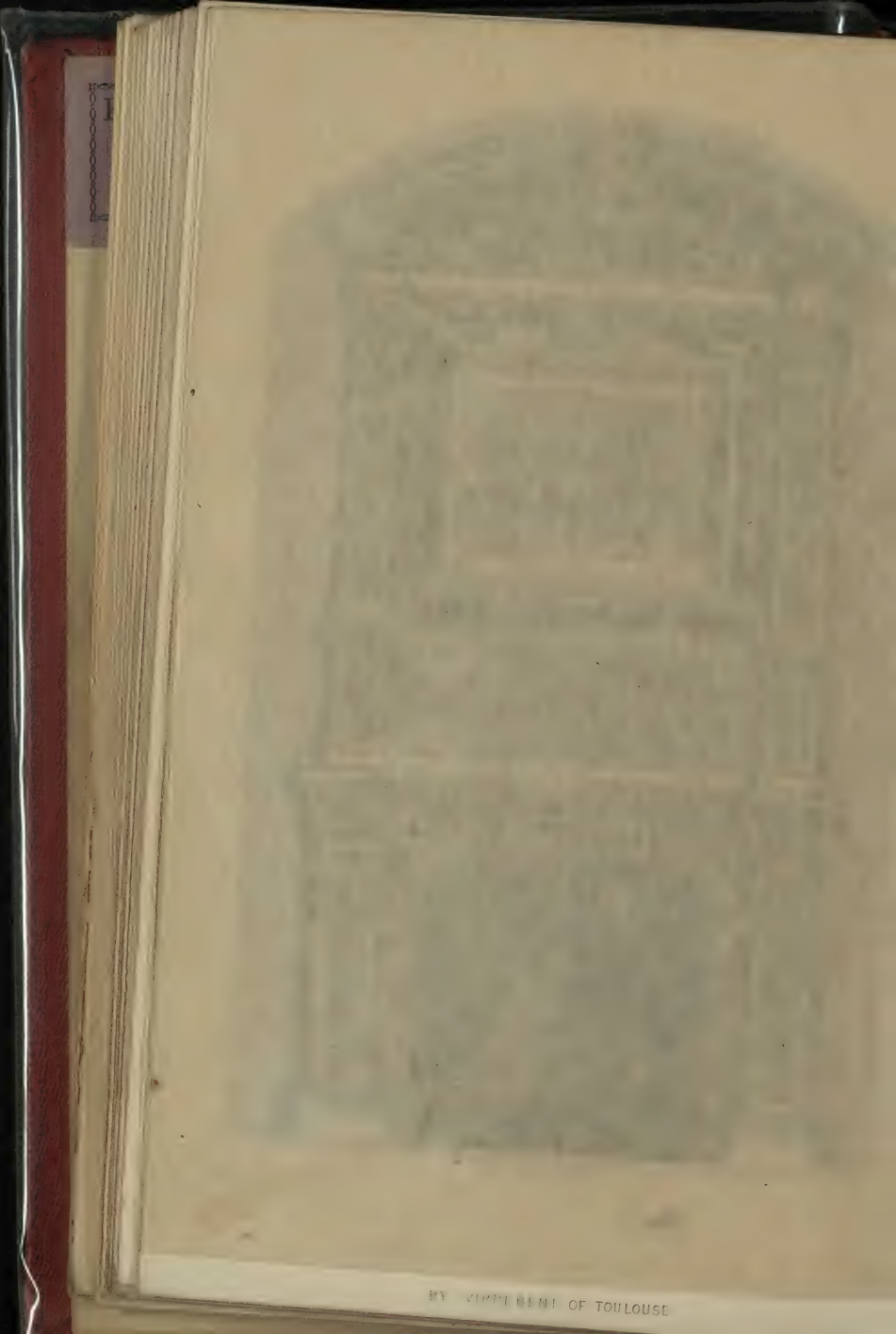
EXHIBITED BY GARRARD.



TERRA COTTA CHIMNEY PIECE

BY VIRBIENT LE PRINCE

BY BARBETTI OF SIENA



Engraved by W. Smallfield

CARVED CABINET IN ROSEWOOD.

BY BARBETTI OF SIENA

THE INFANT MOSES.

THE ORIGINAL BY DE CUYPER, ANTWERP.

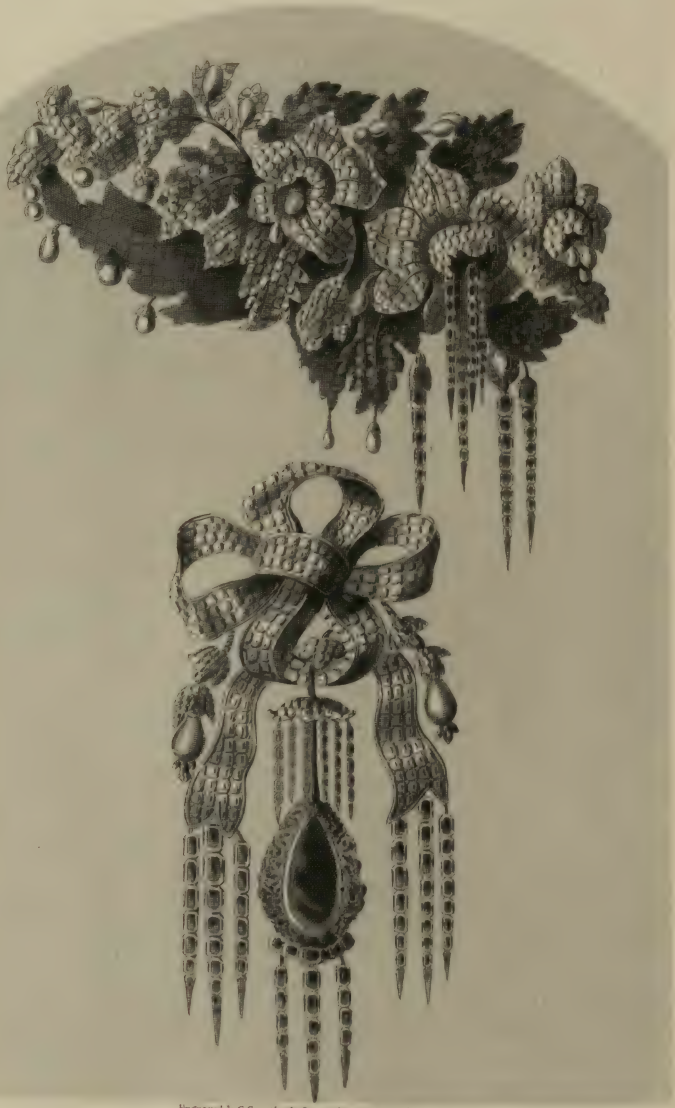
Engraved by [illegible] from a Drawing by J. Rousseau.

SCENE IN A MEXICAN COURT YARD.

Engraved by D. Pound, from a Drawing by J. Tomlinson

DRAGGING THE DEAD BULL OUT OF THE ARENA

M. MOLINIER'S MEXICAN FIGURES



Engraved by G Greatbach, from a Drawing by H Mason.

THE QUEEN OF SPAIN'S JEWELS.

HEAD DRESS AND SHOULDER KNOT IN DIAMONDS, PEARLS, RUBIES AND EMERALDS.

MANUFACTURED BY LEMONNIERE PARIS

THE QUEEN OF SPAINS JEWELS.

BOUQUET, &c. IN DIAMONDS, PEARLS AND RUBIES.

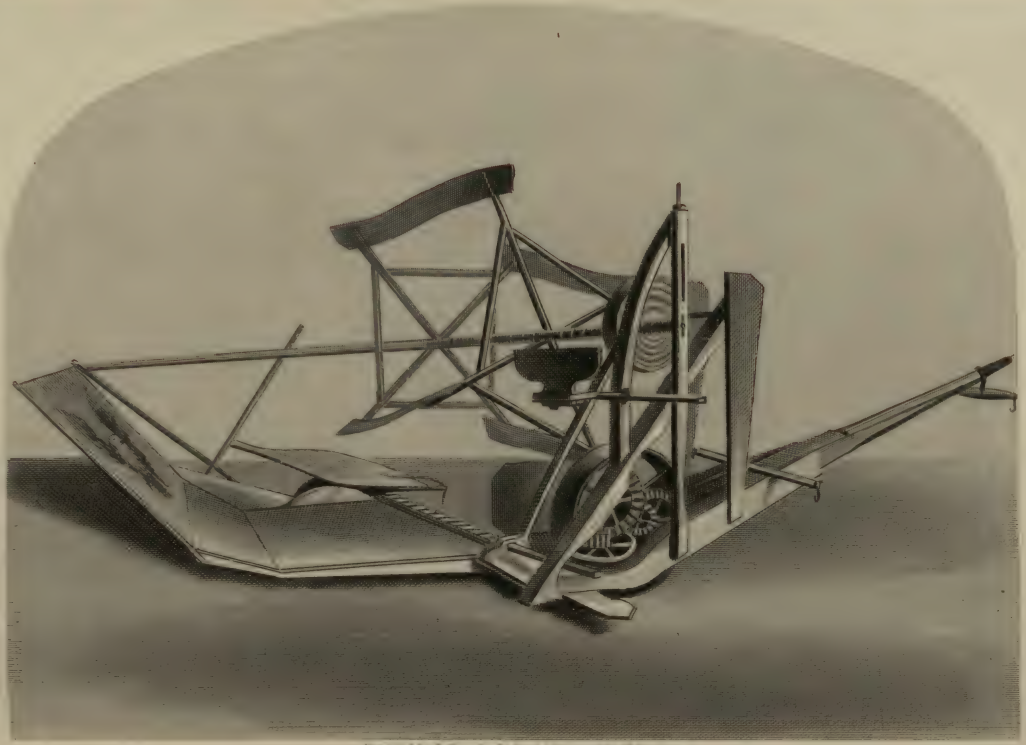
MANUFACTURED BY LEMONNIER, PARIS.

GREAT EXHIBITION, MAIN AVENUE.

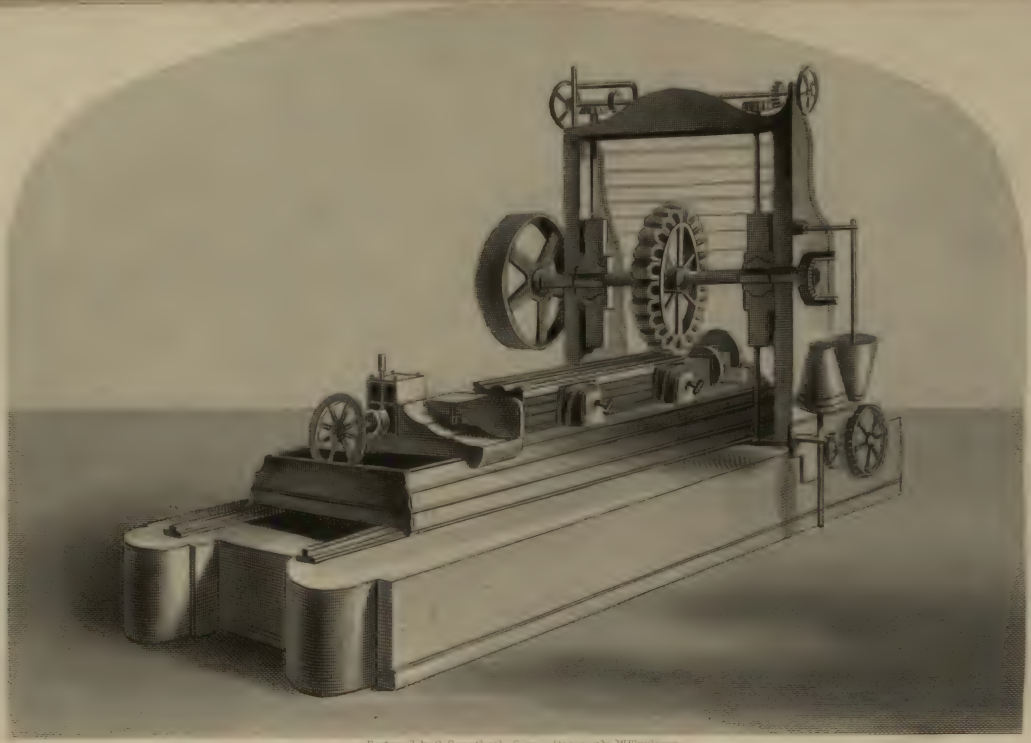
LOOKING EAST

SILVER SOUP TUREEN.

MANUFACTURED BY ONION



AMERICAN REAPING MACHINE



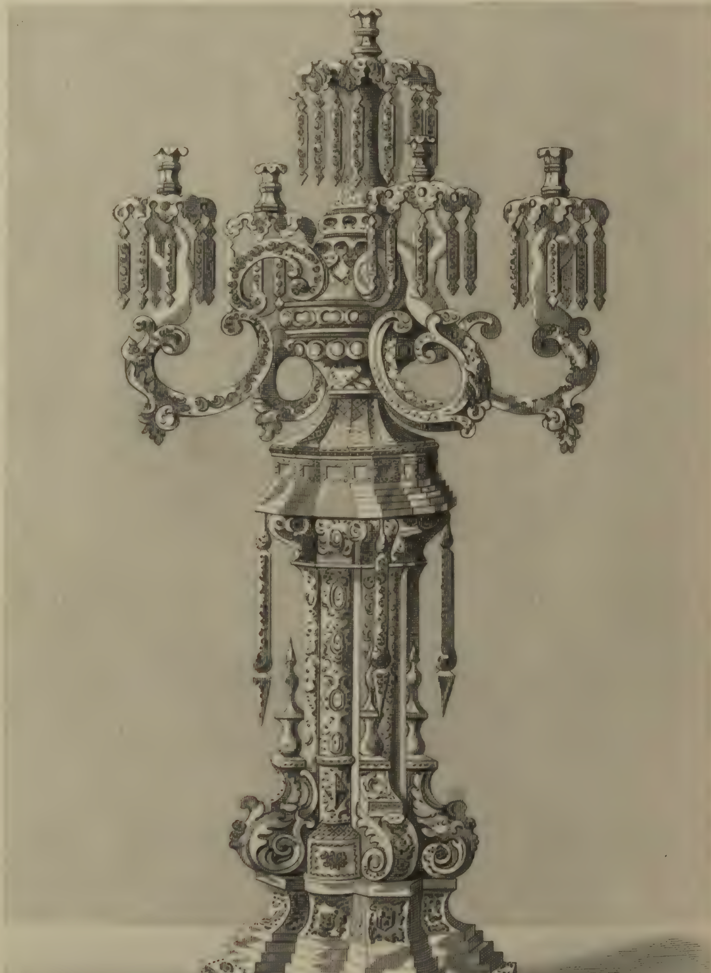
Engraved by G. Greatbach. From a Drawing by W. Tomlinson

STONE-CUTTING MACHINE.

SILVER VASE

BY WAGNER DRESDEN

FOUNTAIN À THÉ.



BOHEMIAN COLOURED GLASS CANDELABRUM

Engraved by T. Phillips from a Drawing by E. Morris

OR-MOLU CHANDELIER

MANUFACTURED BY CORNELIUS & Co. NEW YORK.

Engraved by G. Greatbatch from a Drawing by W. Tomkinson

LONDON BRIGADE FIRE-ENGINE "PRINCE ALBERT"

Engraved by [illegible] from a Drawing by W. [illegible]

CANADIAN FIRE ENGINE

fire-damp we shall not at present notice; but confine our attention to the dangers attending the mode of ascending and descending mines. The miners place themselves in a basket, or "cage," as it is commonly called, and are lowered to, or raised from, their work by a rope or chain. If either of these break from any accidental circumstance, or are, as is unfortunately sometimes the case, wilfully cut, the unfortunate men are dashed to pieces at the bottom of the shaft. From a return of the number of deaths from accidents in mines, in 1848, we find that out of 415 cases, eighty-nine were from breakage of ropes or chains. The apparatus has been severely tested in several mines, and has been proved to afford an amount of safety to the miner, which he has not hitherto enjoyed. It consists of a cage or basket, attached to guide-rods or chains, and was represented as carrying two tubs of coal down the sides of the shaft, and the rope or chain holding the cage was shown as broken; the self-acting springs or arms, forming levers attached to the top of the cage, were liberated, and these being wedged most securely upon the guide-rods, the cage became necessarily fixed and its descent arrested. The apparatus has thus no chance of falling more than a few inches, after the rope or chain is broken, and the stop is at the same time so complete, that no danger is to be feared from any recoil. In an experiment made at Usworth Colliery, Durham—the cage, containing two tubs loaded with coal, the whole weight of cage, tubs and coal, being 48 cwt.—when the rope was disengaged, the apparatus instantaneously took effect, and the whole mass was firmly fixed to the guide-rods. On another occasion, at the same colliery, the cage, with a total weight of 50 cwt., was safely arrested in its descent, which, but for the "safety" arrangement, must have been precipitated to the bottom of the shaft, 1,000 feet below. But this was not all: two of the workmen then placed themselves in the cage, and by a touch of their hands, stopped this weight of 50 cwt. and themselves in addition, instantaneously; and so satisfied were four of the gentlemen

present of its efficient nature, that they unhesitatingly committed themselves with a load of upwards of 40 cwt., to its *protecting operations,* with the same *successful results.* Another arrangement has been introduced, by which the casualties arising from the rope being drawn over the pulley are entirely prevented. It must be understood that this apparatus is perfectly self-acting, and that the greater the weights which may be in the cage, the tighter do the wedges hold upon the guide-rods, in the event of any accident taking place. The inventors of such an apparatus are well deserving of a "civic crown."

Suspension-Bridge over the Dnieper.—This model, by Mr. James, of Broadwall, Southwark, gave an accurate idea of the stupendous works erected over the river Dnieper, by command of the Emperor of Russia. It was designed by Mr. C. Vignolles, and is the counterpart of a similar model made for the emperor, at a cost of more than £12,000. Considered as a work of great engineering skill, it was the most perfect thing in the whole building. Only fancy the difference between the state of Russia—by no means a first-class nation—now-a-days, and its condition when Peter the Great came to England for information, and worked as a ship's carpenter in Plymouth dockyard! And these improvements come not out of a spirit of conciliation existing among the nobles of the imperial court, but are thrust on its attention by the irresistible force of that progressive feeling, which has found a voice even among the serfs of South Russia. Nicholas the First may not know the fact—but it is nevertheless a fact—that in building the suspension-bridge over the Dnieper at Kieff, he is not only providing his subjects with a safe and commodious means of passage over the deep and rapid river, but that he is advancing the cause of science and liberty all over the world. The suspension-bridge, a quarter of a mile long, in place of the crazy erection of boats hitherto employed, is only another instance of the march of mind, and the supremacy of nineteenth century civilisation. As to the model itself, it will be sufficient to say that it was

constructed on a scale of an eighth of an inch; all the details were finished with such nicety, even to the size of the bolts and chains, that a perfect bridge on a large scale might have been executed from it; and that it consisted of 6,880 pieces of wood and 87,097 separate pieces of metal. The Emperor of Russia was so pleased with the model, of which this was a fac-simile, that he gave Mr. James a diamond ring, said to be worth £200. It is now set up in the winter garden of St. Petersburg.

The models of the great Britannia Tubular-bridge, connecting the island of Anglesea with the main land, and that of Mr. Brunel's bridge over the Wye, were extremely interesting; the first especially, as forming part of our great net-work of railways which are rapidly intersecting the country.

Salter's Model of the Great Opening Bridge at Selby.—Amongst the interesting models exhibited, that by Salter of the great opening bridge at Selby, on the line of the Hull and Selby Railway, was particularly worthy of notice, the work represented being of so novel a character, on account of its large span. The river Ouse is at all times rapid, and particularly so during the times of the frequent freshes or floods; it required, therefore, that a bridge of peculiar construction should be resorted to, in order to meet the requirements of the case. By the act of parliament for the Hull and Selby Railway, which obtained the sanction of the legislature in 1836, it was stipulated that the bridge at Selby should have an opening arch of forty-four feet span, for the sea-borne vessels trading to York. Messrs. Walker and Burges, who have erected so many of the cast-iron bridges which are dotted about in different parts of the kingdom, were engineers for the railway; the bridge, therefore, was executed under their direction; the contract for the iron work being undertaken by the Butterfly Iron Company, and carried out with the usual spirit displayed by that firm. The river, at the point of crossing, is about 200 feet in width and at low water, fourteen feet in depth, the

tide rising nine feet at springs and four feet at neaps. The bed of the river consists of silt, resting on a thin bed of sand, beneath which is clay of a hard quality. The bridge was commenced in the autumn of 1837, and finished in the spring of 1840. The land abutments are constructed of brickwork and masonry, resting on piles; those under the west abutment being eighteen feet, and those under the opposite abutment, twenty-eight feet long respectively. The intermediate piers for the support of the superstructure are formed of open pile work, the piles being driven fifteen feet into the solid clay, and their tops surmounted with cap sills of large scantling, upon which the iron-work is bedded. To give additional stiffness to the two centre piers, a plan was resorted to in the bracing, which, although novel in itself, was executed with very little difficulty, and is found, after years of experience, fully to answer the purpose. This was effected by rounding the centre piles for a portion of their length, so as to allow the cast-iron sockets to descend and take a solid bearing on the square shoulders of the piles, to which were connected the long timber braces; so that when the socket, with the braces attached, were let down to their bearings, the tops of these braces were brought to their places at once, and secured to the cap sills.

Stephenson's Britannia Bridge.—The model executed by James, of Broadwall, was to a scale; all the parts bore an exact proportion to things as they were. The bridge consisted of two tubes, forming the up and down lines; and each tube was made of four different parts, namely, two land tubes, of 230 feet span each, and two centre tubes, of 460 feet span; when these had been raised to their proper position on the piers (at a height of 103 feet above high-water mark,) they were joined together to form one. The total weight of the two tubes was about 11,000 tons. In the model, one tube was shown complete, stretching across the Straits; and the land tubes having been built on scaffolding in the position they now occupy, the scaffolding was shown. The two central portions of

the second tube illustrated the transits of the tubes from the platforms on which they were built, to their ultimate destination on the piers; one tube was shown being floated to the basement of the piers, and the other in the act of being raised by the hydraulic presses.

The Railway Bridge over the Wye, at Chepstow, by Brunel, was a novelty in engineering. It was composed entirely of wrought-iron. One span was 300 feet, and the others 100. The principle of construction adopted in spanning the 300 feet, seems to have been that of an extravagant trellis; the principle of the trellis was of the same character as the Britannia tubes or any other beams or girders,—that is, the top was subject to compression, and the bottom to extension. This bridge had two lines for the up and down trains. The span of 300 feet consisted of two huge trussed girders, the bottom of each being composed of two simple wrought-iron beams, which resist tension, and between which one of the lines ran, these beams being formed of boiler-plate and riveted together. These two girders were supported at two points, 100 feet apart from each end, from a wrought-iron tube above, which stretched across the whole span, and this tube resisted the compression. This tube also was raised at a considerable elevation above the bottom girders, so that the weight, such as trains, &c., passing along the line, might be properly resolved or distributed over the tube by means of the tye-rods and stays; the 100 feet spans being crossed simply by wrought-iron beams.

Stephenson's High-level Bridge, at Newcastle-upon-Tyne, was also exhibited in model, by Hawks and Co., who were contractors for the iron-work. The banks of the Tyne, both at Newcastle and Gateshead, are exceedingly steep, and are connected by a viaduct, 1,375 feet in length, running at a height of 112 feet above high-water mark. There are six principal openings, each of 126 feet span. The principle of construction is the bow and string; the arches, which form the bow, are of cast-iron, and the rods, which forms the strings, are of wrought-iron, to

resist tension; there are four arches to each span, two on each side; which bear properly on the piers, through the medium of bed-plates, on which the arches rest; and the strings of each arch consist of two wrought-iron rods, keyed to the arches of the abutments. Cast-iron columns, connected to the arches, support a platform above, on which three sets of rails are laid, and they also support another platform below for a carriage-road, the footpaths running between the two arches on each side; this road, in fact, runs along the strings, but has no connexion with them; the arches take the whole weight of both platform, above and below, leaving the strings independent, to resist only the tension. The iron-work required the adjustment of an immense number of parts; yet no joints, and hardly any fastenings are to be seen; in fact, it is difficult to make out how it has been put together.

Ouse-burn Viaduct.—Amongst other objects of interest exhibited by B. Green, of Newcastle-on-Tyne, was a model of the central arch of the Ouse-burn viaduct, on the Newcastle and North Shields Railway; the arches were of timber, built up of layers or planks sufficiently thin to allow being bent to the required sweep. The arch having thus been built up to the required size, was bound together by iron straps, bolts, &c. It was then scientifically strutted, to resist and distribute the thrust properly.

Shields' Models of Bridges, &c., from New South Wales, were exhibited in the colonial department. These engineering contrivances are especially suitable for New South Wales, where, the cost of iron-work being very considerable, the engineer has to economise to the utmost extent the use of this valuable material, and in cases, where practicable, to dispense with it altogether. Mr. Shields' model of a "lattice bridge," and also that of a "railway trestle frame," were of the latter character; and were, therefore, suitable for many other parts of the world—New Zealand, for instance, which abounds with valuable timber, suitable for bridges and similar works. The American engineers have long paid considerable attention

to the best disposition of timbers in the construction of their bridges and extensive railway viaducts; and these have been followed, to some extent, both in the railways of England and Ireland. Mr. Shields' lattice bridge is of round timber, thus getting rid of much expense in the shape of labour, and also in the entire absence of iron fastenings. The model consisted of three lines of vertical round timbers, properly notched, and having two perforations to receive the horizontal timbers. Between each pair of vertical timbers were two diagonal pieces, resting at the bottom on cross-timbers, and framed into the vertical timbers at the top. There were three double sets of horizontal timbers, the upper ones supporting the joists placed transversely, and to which the floor-boards were secured. These joists projected on either side of the bridge, in order to gain additional width of roadway; a wooden railing, properly strutted, completing the whole. The "railway trestle frame" was intended specially as a substitute for embankments, in countries where labour is dear and timber plentiful. The framing was similar to that of the lattice bridge. A third model showed Mr. Shields' economical method of laying the rails in New South Wales, which is the same as that adopted in the north of England, and to a great extent in America; but the peculiar mode of placing the rails and securing them to the timbers were the novel parts of the design.

Model of the Falls of Niagara.—Among the various models found in several parts of the Great Exhibition, was one of the Falls of Niagara, which deservedly attracted a large share of public attention. This model was transferred by Mr. Catlin, from his collection of American-Indian productions, and faithfully represented the "Horse-shoe" and American Falls (the former descending 150 feet, and the latter 163 feet). The various mills, hotels, residences, roads and Goat Island, extending to seventy-five acres, embraced an extent of country equal to nearly a square mile; and, being constructed to the scale of ninety feet to an inch, every object was very distinctly shown.

The amount of water descending over the two falls is said to be equal to 1,715,000 tons per minute, and which is chiefly derived from the drainage of Lake Superior, Lake of the Woods, Lake Michigan, Lake Huron, Lake St. Clair and Lake Erie. The sublime and reverential feelings the object itself inspires, are finely set forth in the following stanzas, written on the spot, on beholding it for the first time, by that intrepid traveller, James Silk Buckingham, who has left scarcely any part of the civilised globe unvisited; and who, wherever he has turned his steps, has always made the existing condition of the human race the subject of his most eager enquiries, as its advancement and happiness have ever been the objects of his unwearied benevolence.

HAIL! sovereign of the world of floods, whose majesty and might,
First dazzles, then enraptures, then o'erawes the aching sight.
The pomp of kings and emperors, in every clime and zone,
Grows dim beneath the splendour of thy glorious watery throne.

No fleets can stop thy progress, no armies bid thee stay—
But onward, onward, onward, thy march still holds its way.
The rising mist that veils thee, as thine herald goes before;
And the music that proclaims thee, is the thundering cataract's roar.

Thy diadem is an emerald green, of the clearest, purest hue,
Set round with waves of snow-white foam, and spray of feathery dew;
While tresses of the brightest pearls float o'er thine ample sheet,
And the rainbow lays its gorgeous gems in tribute at thy feet.

Thy reign is of the ancient days, thy sceptre from on high,
Thy birth was when the morning stars together sung for joy.
The sun, the moon, and all the orbs that shine upon thee now,
Saw the first wreath of glory that entwined thine infant brow.

And from that hour to this, in which I gaze upon thy stream,
From age to age in winter's frost, or summer's sultry beam,
By day, by night, without a pause, thy waves, with loud acclaim,
In ceaseless sounds have still proclaimed the great Eternal's name.

And whether on thy forest banks the Indian of the wood,
Or, since his days, the red man's foe on his fatherland hath stood;
Who'er hath seen thine incense rise, or heard thy torrent's roar,
Must have bent before the God of all, to worship and adore.

Accept then, O Supremely Great! O Infinite! O God!
From this primeval altar, the green and virgin sod,
The humble homage that my soul in gratitude would pay
To Thee! whose shield has guarded me in all my wandering way.

For if the ocean be as naught in the hollow of thine hand,
And the stars of the bright firmament, in thy balance grains of sand;
If Niagara's rolling flood seem great to us who lowly bow,
Oh! great Creator of the whole, how passing great art Thou!

But though thy power be greater than the finite mind may scan,
Still greater is thy mercy, shown to weak, dependent man—
For him Thou cloth'st the fertile fields, with herb, and fruit, and seed
For him, the woods, the lakes, the seas, supply his hourly need.

Around, on high, or far, or near, the universal whole
Proclaims thy glory, as the orbs in their fixed courses roll;
And from Creation's grateful voice the hymn ascends above,
While Heaven re-echoes back to Earth, the chorus, 'GOD IS LOVE.'

CHAPTER XIII.

GLEANINGS AND REMINISCENCES—*(Continued.)*

THE RAILWAY PRINTING TICKET—CURIOUS FACTS—THE QUEEN'S DRAWING-ROOM—WARDIAN CASES—FOX'S MAGNETISED BALANCE—INDIA-RUBBER AIR GUN—SMITH'S COMIC ELECTRIC TELEGRAPH—FIRE-EXTINGUISHING CEILING—SPITALFIELDS' SILK TROPHY—FUR AND FEATHER TROPHIES—THE LADIES' CARPET—FACEY'S ORRERY—SELF-ACTING FIRE-ALARUM AND RAILWAY WHISTLE—GRAPHIC DELINEATION—IVORY CARVINGS—COLOSSAL PORPHYRY VASE—MOLLENBORGH'S CANDELABRUM.

The Railway Printing Ticket.—What a simple thing is a railway ticket! merely a square inch of cardboard, coloured blue, white, or green, as the case may be, with certain cabalistic figures across its face, and the names of the towns of departure and arrival printed thereon!

Passengers by railway—and they are numbered, now-a-days, by tens of thousands—step from their cabs or omnibuses, not always without a dispute with the driver, pass into the station, walk up to the counter, pay their money, and receive, in return, the little ticket before mentioned. How few travellers by rail ever bethought themselves how that ticket was produced. To be sure, they saw the station clerk pass a piece of pasteboard into a sort of iron cylinder, heard a sharp click, and the next instant saw the ticket skimming across the counter towards them, by means of an official fillip, acquired by long practice; but of the ticket itself they knew nothing, and, of course, cared nothing about it, except as to its actual use. The piece of paper which is to frank them all the way to Liverpool, Edinburgh, Ireland, or elsewhere, is shown to the guard in waiting, as soon as the passengers by that train are seated and ready to start; is passed into a side-pocket, or watch-fob, if the passenger happen to be a gentleman, or carefully deposited in a purse or a glove, if the aforesaid passenger be a lady; and is altogether forgotten by the *habitués* of railways, or nervously felt for, and looked at every now and then, by the noviciates in travelling experiences, till it is peremptorily called for at the end of the journey—"Get your tickets ready!" "Your ticket, ma'am, if you please," is the porter's manner to the first-class passengers; "Ticket, sir," is the style of that official to travellers by the second-class; and "Now, then, tickets!" the ordinary phrase and demeanour adopted towards the riders in parliamentary trains, or the open cattle-trucks, popularly known as the third class. All have their tickets, and all the tickets are alike in form and substance, differing only in colour and numbering. Let us look to the antecedents of these interesting bits of paper.

In the infancy of railway travelling—and even now on some small branches—the passenger-tickets were slips of paper torn from a cheque-book and given to the purchaser, to be delivered up to the guard at the end of the journey.

This plan was soon found to be inconvenient; as, although the tickets were made to correspond with the counterfoil in the book, a vast deal of small peddling, no little purloining by the officials themselves, and many mistakes were continually occurring. To avoid all this, the machine at present in use was invented. By it, all the tickets are numbered consecutively from one to any determinate number. The money taken at each station should correspond with the tickets collected at night; and if the chain in the numbering of the latter be broken, then it is known that there is a ticket lost, or that the guard in attendance has neglected to collect it; on the contrary, if the number of tickets exceeds the amount, then it is certain that some individual must have taken a ride without paying for it, through some collusion with the money-takers or guards. In these cases, the money-takers are held responsible. Suppose the tickets issued on, say June 1st, run from 1,500 to 3,500, and a ticket is discovered with 750 marked on it, which will correspond with a number missing from the previous day's reckoning, then it is discovered at once that some person has travelled twice with the same ticket; and the poor fellow whose duty it is to take the passengers' tickets, is punished for not having exercised proper vigilance, by having to pay the amount of the deficiency out of his own pocket. It is interesting to know that all these mistakes are now rendered of very rare occurrence, and that the loss of tickets by pilfering or collusion is made next to impossible by the invention of this admirable machine—which not only cuts millboards into the proper sizes for railway tickets, but prints, numbers, counts, and packs them as well. The consecutive numbering of the tickets is managed by an automatic wheel, which changes the numbers from one to 9999 without any attention on the part of the workman. The reason for thus consecutiveiy numbering the tickets is in order to avoid forgery and the purloining of the tickets from the cabinets in which they are kept. As a clerk removes a ticket, previous to dating it he always

looks at the preceding ticket to see if the numbers correspond, that he may know if any have been stolen. When the tickets are collected at the end of the journey they are again arranged numerically, as has been before stated; and thus all chance of wrong-doing is prevented. Where there is little temptation, there is little crime. This machine is now in use on several of the large railway lines.

Curious facts connected with the Exhibition.—Of the money received at the doors, £275,000 was in silver, and £81,000 in gold. The weight of the silver coin so taken (at the rate of 28 lb. per £100) would be thirty-five tons, and its bulk 900 cubit feet! The rapid flow of the coin into the hands of the money-takers prevented all examination of each piece as it was received, and £90 of bad silver was taken, but only one piece of bad gold, and that was a half-sovereign. The half-crown was the most usual bad coin; but a much more noticeable fact is, that nearly all the bad money was taken on the half-crown and five shilling days. The cash was received by eighteen money-takers: on the very heavy days six extra ones being employed during the busiest hours. From them it was gathered by three or four money-porters, who carried it to four collectors, charged with the task of counting it. From them it went to two tellers, who verified the sums, and handed it to the final custody of the chief financial officer, Mr. Carpenter, who locked each day's amount in his peculiar iron chests in the building till next morning, when, in boxes, each holding £600, it was borne off in a hackney cab, in charge of a bank of England clerk and a bank porter. The money was received in all forms, ranging between farthings and ten pound notes. Contrary to the notices exhibited, change was given. Occasionally foreigners gave Napoleons, and these coins being mistaken for sovereigns, they received nineteen shillings out, and liberty of admission into the bargain. The monies of America, Hamburg, Germany, and France, were often tendered and taken. The total number of visitors from the 1st of May to the 11th of October was 6,063,986.

The Queen's Drawing-room at the Crystal Palace.—This elegant little apartment was chiefly composed of rich tapestry, the interior being lined with pale blue and white silk, fluted. The furniture was of a very costly character, combining lightness of appearance with splendour of effect. The sofa and chairs were carved and gilt, and covered with light blue silk damask. The carpet, of rich Brussels, was a flowered pattern. Flowers, tastefully disposed, lent their aid to give a pleasing and lively effect to the picture. In the rear of the principal room was a smaller apartment, separated from it merely by a draped partition, in which was a handsome cheval glass, in a gilt frame and stand. Crowds of persons daily thronged to view this little *bijou* of a boudoir—at a respectful distance, however—a cordon being drawn around it, guarded by a policeman.

Wardian Cases.—In various parts of the Great Exhibition building, were to be seen live plants, growing, in some instances, under handsome glass shades, and in other cases in glass frames, of so unprepossessing an appearance that one might naturally be at a loss to account for the reason why objects so uninteresting had been sent to the "World's Fair." These contrivances are called Wardian cases; it having been first discovered by Mr. Ward, that by them plants can be transported to and from distant regions of the globe, and also that by their aid the Londoner can succeed in growing a few flowers to cheer his habitation. Some years ago we remember to have seen the vessel about to start to survey the settlement of Adelaide, in Australia, and we were much delighted to see two or three of these cases filled with small gooseberry and currant trees, in order that the emigrants might enjoy those delicious fruits which we have in such perfection in this country; and now not a week passes but ships arrive bringing plants from the remotest habitable regions in these Wardian cases, which have thus conferred upon us a power of procuring exotic vegetable productions, which before their introduction was never possessed. These

cases formed, as it were, a little world of themselves, in which those who cultivate plants might observe many peculiarities. From being closed, the heat of the sun bestowed upon them a very high temperature at times, and the hygrometric state of the atmosphere within varied according to circumstances, in a manner which interested the cultivator of plants, and gave him ample means to exercise his observation and talent. In London but very few plants will thrive. The Oriental plane rears its head in the heart of the City, in Cheapside, and forms a stately tree. Russell-square and Guildford-street exhibit, also, noble specimens of this beautiful tree; but coming into leaf late, and shedding its foliage early, it is not so susceptible of those influences which injure other plants. The lime-tree will also partially flourish; and in the very centre of the bank two noble and ancient limes shade the parlour from the scorching sun of summer, and yearly cast forth delicious perfume from abundant flowers. With these exceptions, flowers and vegetable productions can scarcely be cultivated in London, except with the aid of a Ward's case. Residing in the very centre of the metropolis, we now write with two beautiful Ward's cases before us, which exhibit the most luxuriant foliage. In these cases we have at this moment the beautiful wax plant, or *Hoya carnosa*, in abundant flower. We have recently introduced the newly imported and lovely *Hoya bella*, which is also now in flower; and the odoriferous *Francisea Hopeana* is always ready to refresh us by its scent, on opening the door of the case. We have five species of *Lycopodia*, which gratify the eye by their luxuriant green; and no less than fifteen or sixteen species of exotic ferns gladden the sight by their charming forms, their verdant foliage, and luxuriant appearance. The leaves of the *Maranta bicolor*, never soiled by wet, are of surpassing beauty; and several species of *Achemenes* are rapidly growing to display their brilliant colours in the latter part of summer. Many of our plants have been in their present situation for ten years. In one of the cases exhibited, was a specimen of

the celebrated Irish fern growing in full health, and the lovely little Tunbridge Wells' filmy fern also luxuriating. Our country friends will, doubtless, be much surprised when they are told that a small plant of the former fern, which grows wild in the British isles, fetches from ten to thirty shillings in London. The sale of ferns and native orchids has become a trade in London. Mr. Marshall has lately constructed a Wardian aquatic case, wherein he grows many curious plants; and the miniature pond is overhung by ferns, which, doubtless, will thrive well in that situation. By simply preventing the access of the London smoke to injure the leaves, we have this year succeeded in growing cucumbers in the very centre of the metropolis; showing what may be effected when the deleterious gases which emanate from the combustion of coal are prevented from exercising their baneful influence.

Fox's Magnetised Balance.—One of the most interesting objects in the department of philosophical instruments, was Fox's magnetised balance, capable, as was stated, of weighing to the $\frac{1}{10000}$th of a grain: what was the extreme weight which it would bear was not mentioned. The most delicate balance previously in existence, that of the Institute of France, turns we believe, with the $\frac{1}{7000}$th of a grain. Various other chemical balances, as by De Grave and Co., and especially one by Oertling (performing to the $\frac{1}{1000}$th of a grain, when loaded with 1000 grains, or $\frac{1}{1000000}$th of the entire weight), was also worthy of notice. Several balances of foreign make (Lumhe of Berlin) seemed very carefully executed. It is to be regretted that these and various other articles for scientific purposes of foreign make could not have had their prices affixed for the information of the apparatus-buying public in England.

India-rubber Air-gun.—Among the newly invented articles which the Exhibition enabled inventors to bring before the public—although they were not so numerous as they would have been, had a system of protection for inventions been assured at an earlier period—there were

some which displayed a considerable amount of ingenuity. As an instance, we may mention the new India-rubber air-gun which was exhibited in class eight, and bearing the catalogue number, 254. It was the invention of Mr. John Shaw, musical-instrument maker of Glossop, favourably known as the author of one or two important improvements in wind instruments. The great singularity of the new air-gun consisted in the entire absence of air-pump, reservoir, and valves, which in the common air-gun are attended by no small amount of trouble, and some personal danger. The air which expelled the ball was powerfully compressed *at the moment of discharge*, by a piston acting within a cylinder, and moved with great force and rapidity by the sudden contraction of a spring, composed of a number of vulcanised India-rubber rings, previously extended by hand in a very simple and easy manner; and the ball was propelled with a force quite equal to that exerted in the common air-gun. It had this advantage, also, that its discharges were always uniform in strength, and could be made with great precision, facility, and safety. Specimens of flattened bullets were exhibited in the case, which shewed its power to be fully equal to the average shots of the ordinary air-gun. The invention was certainly a most ingenious application of the elastic force of vulcanised India-rubber, an article which possesses so many useful qualities, and the application of which, to a vast variety of purposes, is now so general and progressive.

G. R. Smith's Comic Electric Teleyraph.—Among the telegraphs exhibited in that portion of the middle gallery north of the British side of the nave, which was appropriated to philosophical instruments, one was always sure to attract the attention of those who chose to pause to examine the numerous examples of the application of electricity, to the transmission of signals between distant places. Surely, the inventor of this contrivance—called a comic electric telegraph—must have determined in his own mind to produce an instrument, at any rate, in external appearance, wholly different from anything of the

kind which had previously appeared. In this he has certainly succeeded; but we are not at present prepared to say to what extent a communication, by this instrument, may be transmitted. As the inventor truly says, the instrument would, no doubt, prove an amusing and instructive addition to the ornaments of the drawing-room, as it might be used to illustrate the principle of magnetic induction. The action on the eyes and mouth of the comic face was produced by three bent iron bars within the figure, which were rendered magnetic by induction, and attracted either of the features, by means of armatures attached thereto. In addition to these novel signals, there were also the signs —, +, \, by which not only all the letters of the alphabet were represented, but also the end of each word and sentence respectively properly indicated. These signals were shown by the elevation of shutters above the face. As each of the bars were capable of being separately magnetised, either of the signals could be shown at the will of the manipulator, by touching the corresponding key in front of the figure. The telegraphic alphabet of Mr. Smith was made up of combinations of lines and crosses, and was, therefore, rather of a retrograding character as regards this important branch of telegraphy, which has been sadly neglected by most of the inventors of telegraphs. A bell, used to call attention, was placed inside the figure.

Fire-extinguishing Ceiling.—This automatic contrivance was exhibited by Mr. Bergin, for extinguishing fires in laundries, and other parts of a building, specially liable to such accidents. The inventor proposes to have a large tank, containing water, fixed at the top of the room; this tank to be perforated with holes, and to be fitted with a valve plug, like a shower bath; the plug to be held down by a string, to be fixed near the most combustible materials; in case of fire, the string would be burnt, the plug would rise, and a deluge of water would be showered down on the incipient conflagration.

Spitalfields Silk Trophy.—It was intended at first that

the silks of Spitalfields should be contributed by various manufacturers; and that exhibitors in this class should unite in forming a great silken trophy emblematical of their trade. This arrangement, however, was found difficult to carry out, and Messrs. Keith and Co., as manufacturers of the largest kind of silk goods, for damasks, &c., undertook to provide sufficient materials to form a splendid type of the metropolitan silk looms. This was in every way an interesting object; for it showed at one view the industrial products of the Spitalfields weavers, the descendants of those poor French emigrants whom the revocation of the Edict of Nantes drove to our shores—then, as now, the refuge of the destitute and the oppressed of all nations. It consisted of an elegant arrangement of silk brocades, tabarets, damasks, brocatelles, &c., to the height of upwards of fifty feet; the sides of the lower part being intersected with mirrors of immense dimensions, which reflected in certain angles the draped and curtain-like arrangement of the rich and gorgeous materials,—the whole producing an effect at once grand and imposing. The trophy was erected under the superintendence of Mr. George Wallis, the superintendent of textile fabrics, whose original drawings and suggestions were ably carried out and extended by Messrs. Laugher, Dyer, and Co., of Poland-street, Soho, to whom great merit was due for the tasteful and elegant design presented to the public. It was surmounted by flags and emblems, the centre banner being emblazoned with the royal arms; and not the least merit of this elegant arrangement of rich materials was that, by means of interior steps and ladders, the whole might be taken down and re-arranged at intervals with comparatively little trouble or expense.

The Fur and Feather Trophies.—The former exhibited by Messrs. Nicolay, and the latter by Mr. Adcock, were very attractive, if only for the extreme beauty and intrinsic value of the articles themselves. But considered in another light, and viewed as the products of labour—as the rewards for the hunter's toil in deep, rugged forests, or along the

banks of unknown and dangerous streams—these trophies became significant. Suspended from the walls might also be seen numerous specimens of magnificent furs, the outer coverings of numerous varieties of animals.

The Ladies' Carpet.—This praiseworthy specimen of needlework, the joint production of a number of our fair countrywomen, was placed in the left-hand north gallery, just above the crystal fountain, and afforded a valuable testimony of the profitable employment of their leisure hours. They were assisted in their labours by a small committee of gentlemen, who, with Mr. Papworth, the architect, produced a most beautiful design. The carpet was exhibited at the rooms of the Society of Arts, when the ladies who had assembled to inspect the work unanimously pronounced it to be worthy of presentation to Her Majesty. Mr. Francis Fuller, the chairman of the committee, was therefore deputed to learn Her Majesty's pleasure on the subject, and the result was that he had the honour of introducing the Misses Lawrence, Marshall, Cubitt, Simpson, Witten, and Fuller, being a deputation from the lady executants, to Her Majesty, to whom the carpet was presented. The following address was read by Miss Lawrence, who was selected by the deputation to fill the office of spokeswoman :—"May it please your Majesty —On the part of the ladies of Great Britain, we humbly present for your gracious acceptance a specimen of the work that employs the leisure time of our countrywomen. It was commenced with a wish that their skill should have been represented at the Industrial Exhibition of all Nations, but the opinions expressed of their work have so far exceeded their expectations, that they are led to trust it is not unworthy of your Majesty's favourable notice. It is hoped that it illustrates an elegant branch of British industry and taste, and that it develops a source of manufacture which may afford employment to many, especially to those on whom the hand of adversity has been laid. The names of the ladies who have taken a part in the work will be found in the accompanying list, and their

initials form the border of the carpet. With deep and loyal feelings of gratitude for the noble patronage bestowed on British industry, particularly in the present year, we offer this specimen of a work of art fit for your Majesty's gracious acceptance." Here followed the list of the subscribers and executants. Her Majesty was graciously pleased to express her acceptance of the carpet, and also her satisfaction at the careful manner in which the ladies had executed the work. The carpet consisted of a large pattern worked out in Berlin wool, by a hundred and fifty ladies of Great Britain. It was thirty feet in length and twenty in breadth, and was produced in the following manner:—The pattern, originally designed and painted by the artist, was subdivided into detached squares, which were worked by different ladies, and on their completion the squares were reunited so as to complete the design. In the pattern, which consisted partly of geometrical and partly of floral forms, heraldic emblems were also introduced. The initials of the executants were ornamentally arranged, so as to form the external border. The whole design was connected by wreaths or bands of leaves and foliage, the centre group representing the store from whence they had been distributed. This beautiful specimen of ladies' work was exhibited by Her Majesty.

Facey's Orrery.—This ingenious piece of mechanism was designed to assist students of astronomy, and was nine feet in diameter. It represented the principal bodies in the solar system, and showed all the planets and their attendant satellites revolving round the sun in their proper order. To effect this in the machine, it was necessary to employ no fewer than 194 accurately adjusted wheels to other apparatus fitted up on a new principle. In the limited space within which the exemplifications were confined, it was, of course, impossible to show either the comparative sizes or distances of the heavenly bodies. The orrery, however, gave a general idea of the relative positions and revolutions of the planets and satellites, whilst a gentleman attended and gave a description of

some particulars relating to them. The inventor was a Mr. Facey, who, we understand, is a working man, who, by becoming a member of the Temperance Society, felt it necessary to do something to fill up the vacancy of his idle hours. Accordingly, he was led to the study of astronomy, and this was the result of his labour and ingenuity.

Self-acting Fire Alarum and Railway Whistle.—This was an invention by Mr. D. Lloyd Price, a watchmaker of Breconshire, the novelty of which consisted of an extremely delicate and sensitive expanding compound metallic segment, which might be adjusted to suit any temperature by means of a small screw. The exhibitor deposited two of his instruments in the Exhibition, one of which was removed, by permission of the commissioners, to Somerset House, where it was tested by being placed in a room containing about 2,000 cubic feet of air. The machine being adjusted a few degrees above the temperature in the room, a sheet of paper was ignited, and was found sufficient to raise the temperature so as to set the alarum in motion. The mechanism of the instrument consisted simply of a pulley and weight, and a small lever, which was detached by a helix, the whole being enclosed in a small case about 15 by 18 inches, including the small permanent voltaic battery; and, when once fixed, the inventor states that it would not require to be touched for years, and would always remain like a sentinel ready charged, giving instantaneous notice of the approach of the enemy. One of these instruments is sufficient for a whole building, containing any number of rooms, and it may be fixed in any convenient position for alarming the inmates or police in the event of an unusual increase of temperament in any part of the edifice. It is also applicable to the holds of vessels, where, in long voyages, spontaneous combustion and other accidents by fire are likely to happen. The same principle of construction was applied to the steam-whistle invented by the exhibitor, and may be adapted to steam vessels, or railway carriages.

Graphic Delineation.—It is to the general public that the producer of every article of utility turns for encouragement and support—and it is therefore in the hands of the great body of purchasers that the fate of artistic design as applied to manufactures lies. By their judgment, whether good or bad, the key must be given, in harmony with which the artist and the workman must tune their inspirations. Many, we have little doubt, first turned their attention to their responsibilities in this matter on the occasion of their repeated visits to the galleries of the Crystal Palace. There, probably for the first time, they entered on the task of selection in a serious spirit. Actual comparison furnished them with an unerring test of excellence; and many a lesson on the combination of utility and beauty was doubtless there intuitively acquired. The forms of many of the objects displayed were thus imprinted on their imaginations, as standards wherewith to compare others on which their faculties as judicious purchasers might be subsequently exercised. It is not to be expected, however, that the ideas thus formed could be otherwise than crude and imperfect; and it is fortunate that the power of graphic illustration which is now, happily, so universal amongst us, should bring to their aid the materials requisite for fortifying their memories and reviving their original impressions. Who that remembers the costly engravings which illustrate such works as Stuart and Revett's "Athens," and the early publications of the Dilettanti Society and of the Society of Antiquaries—and turns from them to that wonder of the nineteenth century, the "Illustrated London News"—can fail to recognise the remarkable extension of the power of graphic delineation in this country during the last hundred years? Every draughtsman will at once acknowledge the impossibility of depicting rapidly and correctly an unceasing variety of subjects without the constant exercise of a nice power of discrimination between those peculiarities of form which confer either beauty or deformity on each different object. The plethora of sketching, which is the great characteristic

of the present age, as compared with the habit of our forefathers, may be considered to amount almost to a mania; but, while it indicates the excitable temperament of a public ever craving after fresh food for imagination, it by no means implies the absence of that balance of judgment which should exist in every well-regulated mind. While the unceasing swarm of modern periodical publications accumulates from week to week, and almost from day to day, abundant material for the study of the artist, it ministers largely to the amusement of the public; and not to their amusement only—since it provides for those who are willing to use them, lessons of no slight importance. How many are there whose impressions of picturesque form are derived almost exclusively from these sources—the Protæan variety of which serves to demonstrate, that, when treated by the artist's mind and touched by his skill, almost every diversity of style may be alike invested with the aspect of grace and beauty.

A curious and perfectly unique collection of IVORY CARVINGS was furnished by W. D. Hemphill, M.D., Clonmel. Nothing could exceed the delicacy and grace of these specimens. We had a cup covered with intricate tracery, and yet so miraculously thin in texture as to be quite transparent, and standing upon a stem reduced to the slenderness of a knitting-needle. A hyacinth stalk, with its pendant flowers and leaves carved into a delicate and web-like tissue, that appeared absolutely evanescent, stood beside. It seemed as if a breath would dissolve them, so filmy were the ivory leaves, thin as beater's gold, left by the laborious graver of the artist. The specimens were as beautiful in design as they were exquisite in workmanship. The following were among the most conspicuous:—An ivory vase, on an octagonal pillar, ornamented in the Elizabethan style. The pillar of this vase was double spiral, the outside perforated. It was the best thing in the case. A vase of Hippopotamus ivory, perforated, containing white single hyacinth and jonquil, and standing on a fluted pillar of walrus tooth. A vase of ivory on

a walrus-tooth pillar, containing a fuchsia and a lily of the valley. The flowers in this and the preceding were accurately copied from nature. The pillar of the cup was the enamel of the walrus-tooth, which showed its great strength in being able to support the cup without losing its perpendicularity. We are not aware that this substance has hitherto been used for such purposes, as it is generally considered as valueless to the turner. A small cup of Hippopotamus ivory. One dozen dessert knife-handles of African ivory, each of a different pattern, and forming a harlequin set. A pastile burner, of ivory and walrus-tooth, shaped like a Grecian temple. The altar was hollow: on being raised from its plinth a little silver dish appeared, in which was to be placed the lighted pastile, the smoke of which ascended as incense from the altar. A match-holder of African black-wood and ivory. A crochet-needle, &c.

The colossal Porphyry Vase graced the avenue of the eastern or foreign side of the Crystal Palace. It was, when exhibited, the property of the king of Sweden; but it has since been presented by that monarch to the prince consort. It, together with a table with inlaid top composed of different descriptions of Swedish stones, was manufactured at the porphyry works at Elfdahl. These, with some carriages, a spinning-wheel, and other curious objects, formed the principal attractions of the closing days of the Exhibition—at least as far as the foreign half of the building was concerned.

A large and magnificent Candelabrum, by Mollenborgh, although perhaps not purely artistic, exhibited great originality. It consisted of a stem made to imitate that of a tree, on either side of which was sitting a knight in full northern hunting costume, with dog, gun, spear, and sword. On the upper part of the object, however, there was an addition never seen on a candlestick before, at least in England; namely, a painting on glass. But notwithstanding an anomaly of such an addition, the effect was decidedly good. The picture represented the interior of

a Swedish dwelling-house, with groups of figures variously employed, the frame being formed of the foliage of the tree beneath. The whole was formed in chiselled silver, and displayed considerable taste in execution, not to say genius in design.

CHAPTER XIV.

ARTISTS' IMPLEMENTS.

INTRODUCTORY REMARKS—MILLER—ROWNEY AND CO.—KEARNEY—ROBERSON AND CO.—REEVES AND SON—WAX COLOURS—BLACK LEAD PENCILS — GERMAN PENCILS — GREEN AND FAHEY—COOK—HARVEY—WATSON—CHEAP FRAMES—GEAR, COMPOSITION FOR IVORY—SIR W. NEWTON—MINIATURES—WINSOR AND NEWTON, CHEMICALS—ACKERMANN AND CO.—GRUNDY.

From the earliest history of painting, we learn that artists were invariably in the habit of mixing their own colours and making their own brushes. This practice has continued within comparatively a few years of our own time. For information with reference to the former fact, we would refer to Mrs. Merrifield's elegant translation of Cennino Cennini's *Treatise on Painting*, which was contributed to our art literature in 1844, and deserves to be extensively known. There are but few, if any, of our artists who now grind or temper their colours, but who, on the contrary, prefer purchasing them from the colourmen ready for use. This practice forms a new era in art, and it may be one of considerable consequence to its progress. The artists, it must be admitted, thus gain some advantage over the old method; although that knowledge of the properties of each colour, its durability or fugaciousness, with which the masters of old were necessarily acquainted, is by this course, in most cases, denied to the moderns. So seductive is this plan, that even the artists

of Italy, of Holland, &c., have, upon their arrival in England, fallen into it. It is well known that Mr. Sang, amongst these, when he left Rome for England, partook of the system generally adopted here. This facility he found to his cost not always advisable with regard to every colour; and he had to fall back upon the practice of his native country, and that of many of his Munich brethren in art, and he prepares most of his media now himself, and hence that unrivalled brilliancy and transparency of tints as exemplified in all those of his works painted within the last six years. It may be questioned whether the permanence of ancient pictures is not attributable to the elaborate insight of their painters into the nature of the pigments they made use of, and, above all, to the simple manipulation of their works, and the few colours actually enlisted into their service. It is obvious that the number of colours since the time referred to has been considerably augmented; and now, as may be seen by any list procurable at artists' warehouses, they amount to an aggregate almost sufficient to deter the beginner from entering the lists of art. To those who would wish to make themselves conversant with the several names and the properties of pigments, we would recommend an attentive study of Mr. Field's *Chromatopography*, who, to a profound chemical research into the capacities of all colours for good or ill, adds much general information invaluable to artists. Upon matters of detail it must be obvious we should be necessarily terse; although it is difficult, at the same time, to confine ourselves to generalities where the subject is so replete and tempting; and therefore we plunge at once *in medias res*. It is then with "Artists' Implements" of our own period with which we have to deal, and as they were represented at the Exhibition of which we have to write.

No. 1, in the Fine Art Court, showed us several contributions from Mr. T. Miller, of Long Acre. These consisted of specimens of paintings in "silica colours" and "glass medium," but which appeared to exemplify no

one particular virtue unattainable by other pigments. Most of the pictures themselves, more particularly that of the "Genius of Peace," were distinguished for considerable ability in handling, and a correct probationary course of study. In that of Mr. Corbould's "Britons deploring the Departure of the Romans," we fancy we detected amidst its "trick," more particularly in the orange mantle, in the surge of the sea, and on the shore, an indication of "body," and the presence of a medium which belongs less to the element of water, than of that of gums, resinous compounds, or of oil. As a work of art, we object not to the use of any extraneous aid; we have to deal with it as an evidence of the powers of a particular and express fact; and we could, therefore, have desired that, for the sake of art, that which appeals to us as possessing extraordinary claims upon attention, should have brought with it the first necessary proofs of superiority. The brushes in this case appeared admirably made; and, in this respect, Mr. Miller, we believe, stands almost alone, having had a long practical experience in this branch of trade, which requires an intimate knowledge of the wants and caprices of the artist.

Rowney and Co., of Rathbone-place.—These exhibitors savour a good deal of the fashion of the time, and gave us an almost bewildering classification of colours. Their dividing Naples yellow into tints is, however, a valuable exception, and their desire to supply the artist with a cheap, and, at the same time, a good article, is entitled to praise. W. H. Kearney, Brompton, gave examples of crayon painting, executed with his Venetian pastils, which are impervious to damp, and, therefore, adapted to many decorations hitherto beyond the reach of ordinary painting. Roberson and Co., of Long-acre, showed a very good selection of canvas, painting-brushes, and pencils, which was indicative of a sterling respectability without meretricious allurement. The palette-knife, for placing the colour on the canvas or panel, without the aid of the brush, is a neat adaptation of the common trowel-handle,

and will be found of much service, where boldness of *impasto* is required. There were several specimens of water-colours, in collapsible tubes, admirably adapted for sketching from nature; and a newly-invented oil sketch-book, very light and convenient, and which enables the sketcher to carry two wet paintings without injury. The prepared canvas in the same case was worthy of remark, from its being a successful attempt to give to that fabric the surface of fine panel. Messrs. Reeves and Sons, of Cheapside, contributed a case of some importance to artists, inasmuch as it contained the proofs of an efficient substitute for the far-famed black-lead mine of Cumberland, which is now thoroughly exhausted. It is well known, that, for all purposes having reference to art, this lead of Cumberland was unsurpassable; that no other could compare with it in quality of colour, absence of grit, nor was any so easy to erase; indeed, that no other yet found could be thus made use of in its natural state. That from the Balearic Islands is "cindery," that from Ceylon, though purer than any plumbago known, in the excess of its carbon, and the small portion of iron and earthy matter, is too soft and flaky; that termed Mexican is really produced from mines in Bohemia, and is also friable and earthy. Other varieties, from Sicily, from California, from Davis' Straits', and elsewhere, have been tried, but all have proved unfit for the use of the artist. Cumberland lead was the only black-lead that in its native state could be cut into slices; and thus be inserted into the channels of the cedar pencils; this being alone a remarkable test of its superior fitness as a native lead. The substitutes for Cumberland lead are manifold, some or all of the varieties of the leads before mentioned being worked into pencils variously designated "prepared," "purified," or "composition." These different leads, by means of gums and resinous matters, are either kneaded in a plastic state and forced into the channels of the cedar wood, or more frequently combined and ground with substances with which they will bake to the required

hardness, or with others which will fuse, and the mass solidify when cold. Lustre, intense colour, freedom in working, and ready erasure, Cumberland lead possessed in an eminent degree beyond all other leads known; but its uncertain temper and occasional grit—properties common to all leads in a natural state—gave rise to its amalgamation with other substances which have been enumerated; and though some of the qualities in which Cumberland lead failed have been obtained with varying success by these amalgamations, its especial and valuable qualities when pure have in the same ratio been deteriorated and destroyed. Thus the artist has been left to choose between the evils of a native and a spurious lead, until the somewhat recent discovery by Mr. Brockedon of a process by which lead is made perfect. It would seem that these pencils are especially made for Messrs. Reeves and Sons, and that they are unquestionably what they affect to be.

Another important evidence of successful trade enterprise in aid of art is to be found in the water-colours prepared with wax, as was shown in this case. They dissolve with ease, possess great volume and transparency; and, moreover, they cannot be converted into flint by hot temperatures, so often the fate of the ordinary water-colour. The introduction of a medium of the purest wax into the manufacture of water-colours was a stage in the art of water-colour painting deserving of honourable mention. It has given to this delightful department of art facilities of unapproachable character, and tended to rank it very close to that of oil, which it surpasses in its powers of drying, the advantages of smaller space, and ease of carriage. Very many have been the attempts to give body to the colours used with water, and a variety of media have been used for this purpose. One of these is the more particularly worth mentioning, as showing the avidity with which anything new is seized upon, even by the intelligent and discerning, and the effects which followed a too confiding credulity. We allude to the use of

honey for the purposes above stated. This medium certainly had the desired result of keeping the colour with which it was mixed in a moist state; indeed, if the brush was too fully charged with it, those parts of the drawing to which it was applied would not, unless in hot weather, or in a warm room, dry for some time; and even when dry, such drawings, if exposed to a humid atmosphere, became "tacky" again in the folio or elsewhere, and stuck to their unctuous companions in the most sweet but destructive union. A drawing finished with these colours could not be left a moment with safety. The flies, attracted by the tempting treat, would moisten the choicest parts with their probosci, and tattoo the human face divine, or give to that of lovely woman all the appearance of being ravaged by small-pox. It was no unusual thing to find a flock of sheep disappear from a common, a château shattered and unroofed in a night, and a litter of pigs and a cow or two carried away in a *fly*. Nor was the artist himself exempt from the annoyance of their perseverance and pilferings. To paint from summer nature in the open air was to look through a swarm; and the head of the luckless draughtsman became like a hive in the midst of it.

The allusion to a temporary false step in the onward progress of chemical research in art naturally, although in a very opposite category, directs our attention to the subject of "frauds," a very strong term, but nevertheless true—frauds upon artists. It must be in every father's experience—in that of every director of youth—that there is a particular period in a boy's life when the yearning for a "box of paints" becomes positively painful, according to the amount of difficulty which surrounds its possession. A guinea obtained, the next fancy-stationer's is resorted to for the much-coveted box. There it lies upon the counter, with its lid slightly and mysteriously raised, displaying just enough of its contents to increase a desire of ownership. The prize secured and borne homeward, paper ready, and plate upturned, the attractive colours

are rubbed one by one in neat array upon the delf. A good specimen of water-colour has been "lent to copy," and now comes the first essay. All the efforts of the tyro to imitate the flat tint of its sky or the rich *impasto* of the foreground are of no avail. Time and perseverance but add to the vexation. His colours are poor, weak, thin, and washy. He is, however, ignorant of this fact. Young and confiding, the shop which boasts of being "established" at a period when his father was a boy, would never stoop to cheat. He throws aside his attempt and tries again. The acrid qualities of the colours either penetrate through the paper, or, for want of sufficient grinding, their crude and earthy particles are floated about for an instant on the surface, and the next left in spots and patches. Here is a young and ardent lover of nature, stimulated by a noble mind and an intellect delighting in invention, shamefully surrounded in his first encounter by disheartening difficulties which are the more serious because their cause is not understood. At the very threshold of the temple of art he is rudely repulsed by the sordid and fee-seeking, who sell him a clumsy and useless key, and falsely deny that either Talent, or his senior partner Genius, are within. There exists not the shadow of excuse for this abrupt rebuff. The profits upon art appurtenances are large and ample; and the thus adding to positive extortion, the intimidation to modest merit, is as cruel as it is dishonest. But, says the advocate for cupidity, any description of colours will do for a boy to begin with. Then, if such be the case, why charge as for the best? But it is not the fact. It is true that there are professors (save the mark! it is a correct one) of music, who do not hesitate to set a girl down to a piano "of any sort;" but will any rational person, who is impressed with the divine gift of the appreciation of sweet and harmonious sounds, affirm that such a course would not tend to vitiate taste and injure an otherwise correct ear?

We shall add a few more remarks, partly borrowed from an article by Mr. Brockedon, upon the black-lead

pencil, a more important auxiliary to art than would at the first thought be supposed. It is not generally known that lead dust, or inferior plumbago, is combined with sulphuret of antimony, or pure sulpur; and the greater the proportion of this ingredient, the harder the composition. When ground with the lead—generally that called Mexican—the compound is put into an iron pot, or frame, and subjected to the degree of heat required to semifuse the combining ingredients. It is then, whilst hot, put under a press, and kept there until it is cold; when it is turned out as a block, ready to be cut into slices, and inserted in the cedars. The impossibility of rubbing out a composition when sulphuret of antimony is used, led to the rejection of the sulphuret and the employment of sulphur only, treating these ingredients as before. This makes a better composition in the quality of rubbing out; but possesses, in a greater degree than the former, a serious evil. The sulphur is readily set free by bodies which attract it, and memoranda made with this composition can be reproduced although rubbed out, so far as with such composition is practicable. If the place where the writing was be wetted with an alkaline liquor, a sulphate will be formed; and if, after drying, it be again wetted with acetate of lead, it will exhibit the writing in sulphuret of lead. This is obviously a most dangerous property for persons who may require to make notes not intended to remain or be again producible. To an artist it may be very injurious as regards the purity and security of his productions, for many of the colours which have metallic bases, are liable to be effected if they come in contact with the lead of sulphured pencils. A ready and simple experiment will place our readers in possession of an infallible test, and thus protect that portion of them with whom the fact is of consideration from so deceitful an instrument. Draw some lines with the suspected pencil on a sheet of paper, and place these lines in contact with any bright, smooth, silver surface—a spoon for instance; in a few hours, if

these lines contain sulphur, corresponding dark lines will be found on the spoon, formed by the action of the sulphur on the metal. A good black-lead pencil may yet more readily be known. It should work freely; be free from grit, yet without a greasy, soapy touch; bear moderate pressure, have a lustrous and intense black colour, and its marks be easily erased. It should be borne in mind, however, that no pencil appears to be the same at all times. This arises from the nature of the paper, whether hard or soft, or the condition of the atmosphere, which affects it materially. The same pencil, on smooth or rough, moist or dry paper, will mark as if four different pencils had been used. The softer or darker degrees of lead are weaker, and yield more readily than the harder varieties.

The varieties of German pencils, with ornamental exteriors, which have recently been imported in large quantities, are, it appears, made of clay mixed with Bohemian lead, and a glass which fuses at a moderate temperature; these materials are ground in water together, and dried slowly to a stiff plastic state, and then put into a vessel like that used for forming maccaroni; under a powerful press this composition is forced through holes in the bottom of the vessel, thus forming the material into square threads of the required sizes. These are laid in convenient lengths in wooden troughs, which keep them straight until they are thoroughly dried. They are then laid in similar troughs or channels on iron plates, and put in a muffle or furnace, subjected to a degree of heat sufficient to render them hard and insoluble, and are then placed in the channels cut into the wood, and glued there; the different degrees of hardness depend upon the proportion of the ingredients. All these pencils, however, are harsh in use, and their marks cannot be entirely erased.

Green and Fahey, of Charlotte-street, Portman-place, exhibited folding drawing models in three series, illustrative of perspective, and the principles of light and

shade, which will be found of service, both to master and pupil, in the elementary studies of art. J. E. Cook, of Greenock, exhibited prepared panel for amateur painting, which requires but a day or two to be ready for the artist. Mr. Cook is deserving of much praise for this attempt to give facilities for obtaining material to the young beginner, who is too often cramped for the want of the necessary funds. It is related of Wilkie, that, by partly pulling out a drawer from a set, he made himself an efficient easel; and of Sir Benjamin West, that he obtained his first brushes by taking the hair off the tail of a favourite cat. F. Harvey, of Oxford, showed an easel for artists sketching out of doors, containing everything required. This is a judicious arrangement of materials, and one hitherto much wanted. We trust, it will not be long ere greater activity be given to the trade of which Mr. Harvey is a member, by the appointment of professorships of painting, sculpture, and architecture, at our universities. Why should not the youth of England, in their more docile years, acquire a taste for, and a love of art, the more as they are, in after life, to become patrons, and sit in learned conclave at committees of taste upon the merits of the rival works of the greatest men of their day. It would tend greatly to rescue them from egg-throwing and chicken-hazard, and other low and frivolous pursuits, too often the resource of those who have nothing to do, rather than the offspring of innate vice. The sister arts have their professorships; why, then, should painting be driven from the seats of learning? E. F. Watson, of Piccadilly, sent some excellent specimens of gilding, which contrasted strangely with the cheap gold frames around. There are few artists but are aware how much their productions depend upon the frame by which they are surrounded; and while a picture shall appear surpassingly beautiful in one frame, it shall seem poor and ill-conditioned in another.

It may here be remarked, that the "cheap" frames, now so much in vogue, which meet us at every turn, are the

dearest the artist can purchase. The yellow preparation of their groundwork, but once, and barely, covered with gold (and that "gold" too often of a spurious Dutch character), peers through in unutterable poverty of aspect upon the slightest contact or friction, while the warmth of a room creates gaping crevices at each juncture, and cracks and shrivels the composition ornaments as though they consciously shrunk from contact with the green wood and its shabby disguise, upon which they had been so unceremoniously placed.

J. W. Gear exhibited a composition to supersede ivory for large water-colour paintings. The inventor, who is likewise an artist, informs us that it can be manufactured of any requisite size without a join; the colours, he adds, appear brilliant and clear upon it; and, as it is capable of being used in every respect as ivory, without the brittleness of other substitutes, it will be found deserving at least of the attention of the artist. We have no other means of judging of its merits than by the single sample shown in the Exhibition, which, being completely covered with a drawing of but average talent, denied us all opportunity of doing more than quote its discoverer's book. This and similar inventions to supersede ivory, which *once* could only be obtained of a limited size, however praiseworthy, are, where this is the object, no longer of importance, as ivory, by rotatory motion and fixed vertical saws, can now be cut into sheets of almost any extent. This observation will, therefore, apply to Sir W. Newton, who contributed several miniature paintings of his own, to exemplify a power he possesses in secret of "joining ivory together without the seam becoming apparent." These specimens were, however, unfortunately selected for the purpose. The seams, to our eye, *were* apparent, and more particularly in that of "The Homage," where a join ran the full length and breadth of the picture, in defiance of the thick and heavy "handling," obviously intended to hide it.

In Class 2, amongst the "Chemicals," was an exceedingly interesting case from the firm of Messrs. Winsor and

Newton, of Rathbone-place. It is well known in the profession that these exhibitors are essentially practical men, and have very extensive chemical works for artists' colours in the neighbourhood of Kentish Town.

In No. 1, Class 17, a somewhat dark place, was a selection of fancy stationery from the old-established house of Ackermann and Co., of the Strand. Amongst it was a colour-box, fitted up with every requisite the amateur might desire; the whole arranged with great elegance and taste. Mr. Grundy, of Manchester, exhibited, in Class 26, No. 121, some very beautiful specimens of frames, intended to display, to the best advantage, fine engravings, drawings, and other works of art, and adapting them for the tasteful embellishment of the drawing-room, boudoir, &c. Those for drawings were exquisitely beautiful; and by a simple contrivance the works were sunk or inlaid in the *matte*, or mounting, which preserved them from injury, while they were likewise kept perfectly flat, and did not touch the glass. The frames were altogether lighter than usual, took up less space upon the walls, and had a charming appearance when relieved by a buff or scarlet ground. Water-colour drawings, and the lighter descriptions of oil-paintings, are surprisingly benefited by this ornamentation, while prints appear to be very considerably enhanced in value by such means. The new method of mounting water-colour and other drawings, without cutting their edges, we believe, is due to Mr. Grundy; and the advantage of placing them beneath, instead of above, the card-board, &c., owes its origin to his brother, of Regent-street.

The exclusion of the painter's art from participation in the scheme of the Great Exhibition, was an error of judgment on the part of the commissioners, which it seems utterly impossible to account for. At a time when the application of decoration upon the true principles of design is being attempted, under the auspices of government committees, not only in the palaces of the nation and the houses of the great, but also in the more humble abodes of the middle classes (through the operation of schools of

design)—at a time when furniture, dress, and utensils for the table, all come in for a share of the improved taste of an age ambitious in art, it seemed an act of fatuity, when preparing a Grand Exposition of the Works of Industry of all Nations, to have excluded from the lists that very branch of art which affords the highest resources for decoration, as well as the most abundant and varied examples both of composition and colouring. The assiduity and interest with which the thousands who thronged to the Exhibition in Hyde-park examined the miscellaneous contributions of sculpture from all nations, must assure us that the masses are susceptible of enjoyment from the contemplation of works of fine art; and although many of the specimens there presented to them fell far short of the standard of excellence, and although the impromptu criticisms of the multitude by no means evinced an advanced taste, yet we feel so much confidence in the ultimate triumph of truth, which in art is beauty, that we are inclined to look for good practical results even from this scrambling course of self-education, amid a sort of wilderness of wild flowers.

And if good so result from observations on sculpture obtained in this way, by millions who never saw a work of sculpture before, how much more useful to them would be some notion of the principles and practice of painting, involving both composition and colouring—an art much more intimately and generally applicable to the purposes and requirements of social life—and if a comparison by the more critical portion of the community of the works, we can hardly venture to say the schools, of sculpture of various nations, be interesting and instructive, would not a similar comparison of works of painting be at least equally so? The importance of such a comparison to English art it would be impossible to over-rate, when we reflect upon the comparatively short and chequered career which art, since its revival, has had in this country. It is scarcely more than a century and-a-half that art has held any position amongst us; since Sir James Thornhill,

starting in rivalry to La Guerre, the favourite decorator of the mansions of the nobility of that day, received a commission from the state to paint the interior of St. Paul's Cathedral and the hall of Greenwich Hospital, in which he was assisted by a German named André, and which he contracted to do at the rate of £2 per square yard! It is not a century since the first attempt to establish an academy of art was made, inaugurated by the learned and admirable discourses of Sir Joshua Reynolds; and in the course of that period, what have we done towards the formation of a school of art? what definite purpose or rules of taste have we arrived at? The answer to these questions must be given by a silent and significant pointing to the walls of the various exhibition rooms in Trafalgar-square, Suffolk-street, and Pall Mall, where all has long been caprice, and glitter, and wild confusion, and where now a portion of our exhibitants seem to seek for unity of purpose, by devoting their pencils to a miserable copyism of the poorest mediæval models. Thus, whilst in little more than two centuries (Giotto died in 1336, Raffaelle in 1520), revived art in Italy arrived at its highest point of excellence and power under a Raffaelle, who founded a school which, in the persons of a Giulio Romano, a Garofalo, and a Parmegiano, survived some time after him—in England, in about the same period, after various unconcerted efforts, and fostered by much indiscriminating patronage, we find art, having never once attempted a flight of the highest ambition, degenerating at once into the stiff and inanimate mannerism of the twelfth and thirteenth centuries.

There is no hope of remedy for such a state of things, but in wholesome exposure in the broad daylight of public scrutiny. We must meet extravagance with extravagance; and native affectation being confronted by conceits from abroad (where there is much of the same error to complain of), shame and mutual ridicule may correct much; whilst the strong arm of criticism and the loud voice of popular condemnation will do the rest. But it is not only

to an exhibition of modern art of all nations that we should have looked as the means of educating the public taste. The vast avenues of the Crystal Palace, which might, without much trouble, have been prepared for the purpose, would have afforded an admirable opportunity for forming an exhibition of by-gone art, arranged in order of schools; an exhibition of the highest interest and utility, which, from the nature of circumstances, has never yet been carried into effect, and for which the spacious resources of the World's Fair in Hyde-park afforded the first, we trust not the last, opportunity. Of the forthcoming of the necessary materials for furnishing such an exhibition, we cannot entertain a doubt, had the opportunity been afforded, seeing the alacrity with which foreign potentates, and our own most gracious sovereign and her consort freely sent in the costliest articles of jewellery and *vertù* in their possession, to enhance the attraction of the Exhibition; and how their example was followed by wealthy public companies, by noblemen and private gentlemen, each anxious to contribute their or his mite to the general splendour, but who, we are convinced, would have been far more proud to have shown a Raffaelle or a Rembrandt, than a "jewelled hawk" or a necklace once the property of the poor King of Kandy; and the public—the more intellectual portion of it—would have been much more obliged to them for such contributions, and the men of art, and the men of taste of all Europe, would have thanked them for helping to make up a show of precious worth and enduring interest, the recollection of which would have served to light their paths during a life of toil and study in the pursuit of excellence and beauty in art.

It is useless to enlarge upon the practical advantages and the intellectual charm of such an exhibition; it was denied us: and although a department in the Crystal Palace was named the "Fine Arts Court," the very existence of such a compartment was a mockery when coupled with the announcement that—Oil paintings and

water-colour paintings, frescoes, drawings, and engravings, were not to be admitted, except as illustrations or examples of materials and processes employed, neither were portrait busts to be admitted; and no single artist was allowed to exhibit more than three works. It is true that this regulation was not very clearly worded, and that it might have been evaded, as all ill-advised and purposeless laws generally may be. Indeed, we could mention several publishing houses who managed to gain admission for a variety of engravings and water-coloured drawings. But still the general object of the rule was effected, and the Fine Arts' Court was crowded with very ordinary terra cotta casts, including brick-coloured and by no means delicately treated nymphs of heavy proportions, wax models, wax flowers, nicknackeries in colour-printing, and fancy stationery; card models of houses and gardens, dolls dressed in court and other costume, eggshells carved and engraved with fancy views, models in willow-wood, models in paper, and every conceivable absurd toy which could enter into the conception of a boarding-school miss, and which rendered this department, as far as it went, a positive blot upon the otherwise fair face of the Great Industrial Exhibition of all Nations.

And it was really curious to see the shifts which poor Art, being excluded under its ordinary forms, managed to represent itself in the Great Congress of Industry, and what inconsistencies and waste of space this led to. Although "oil painting and water-colour painting, fresco, drawing, and engraving," had been declared inadmissible in their general sense—that is, in their best and noblest performances—the pictorial genius of Europe manifested itself abundantly on all sides in almost every conceivable material but the prohibited canvas; upon porcelain, from France, from Vienna, from Milan, from Dresden; upon glass from Berlin and other parts of Germany; upon tin from Wirtemburg; upon plate-iron from Thuringia. Then we had mosaics from Rome not a few, and beautiful of their kind; and from Munich we had a collection of

"stereschromic" pictures, executed upon wood covered with mortar, "a process intended as a substitute for the (prohibited) fresco-painting." Sir William Newton was allowed wall-room for several pictures upon ivory, representing "The Homage at the Coronation," "The Marriage of her Majesty," the "Christening of the Prince of Wales," &c.; but their reception in his case may, perhaps, be explained by the announcement that the ivory in these works were "joined together by a process of his own invention." Mr. Haslem and Mr. Bone had some enamel pictures in gold—many of them royal portraits, others copies from old masters; and Mr. Essex showed "an extensive collection of enamel paintings," copies from works in royal and noble collections. In short, whilst High Art was rigorously excluded, Little Art was greatly favoured. As to the prohibition of engravings, it was impossible to carry it out; and accordingly we found whole shop-loads of them in various styles in different parts of the building, some framed, others loose. In addition, we were startled, here and there, with some wonderful imitations of engravings, and pen and ink drawings, in silk, in human hair, in crape, &c.: which, as soon as the first impulse of curiosity was over, only left upon the mind of the spectator a feeling of disappointment and irritation.

Whilst upon the subject of simulative processes, we may refer to some "poker drawings," upon wood, by the Rev. W. C. Calvert, and some specimens of the art of "xylopyrography," or charred wood engraving, exhibited by Lieutenant C. Marshall and Mr. J. T. Mitchell, and which were entitled to rank in a higher category than the contrivances named at the close of the preceding paragraph. The latter productions were somewhat similar in appearance to old sepia drawings, and in their process of working had something in common with poker drawings. The difference between charred wood carvings, or engravings, and the said "poker drawings" was, that the former were cut from the surface of hard and white wood, which had been previously completely charred over, the lights and sha-

dows being effected by scraping gradually away the black surface to the necessary depth, according to the shade required, going below where the burning extends for the absolute lights: whereas "poker drawings" are burnt on the surface of white wood, the lights being left and the shades burnt in. One of Mr. Mitchell's specimens was taken from a rare mezzotinto engraving by Prince Rupert, who, by the way, was long supposed to have been the inventor of the last-named process, though of this there is some doubt, it being probable that he learnt the art from Colonel Louis Von Siegan. The subject was "The Execution of St. John the Baptist," after Spagnoletti. The other specimen by this exhibitor was taken from Uwin's "Chapeau de Brigand" (in the Vernon collection), and was of more minute workmanship than the preceding one. Lieutenant Marshall exhibited, we think, three or more of his works in this line, the most important of which was after Raffaelle's cartoon of "St. Paul Preaching."

A small picture ("the Origin of the Quarrel of the Guelphs and the Ghibellines"), by F. R. Pickersgill, A.R.A., was also admitted, not as a specimen of art, but of Rowney's silica colours, in which it was painted. Besides this, we had one or two other specimens of a like kind, and exhibited for a like purpose; as, for instance, two of Concannon's new method of aërial tinting by calcined colours, and some designs in the crayons and chalks of some other manufacturer, whose name we have forgotten. Beneath these, and some other gaudier displays of colours, rainbow or prism fashion, were ranged the brushes, palettes, and other implements necessary for using them; and so complete and instructive was this exposition of art requirements considered by Mr. Rowney, one of the exhibitors, that he placed a little plaster group, entitled "Letting the Cat out of the Bag," in the midst of his compartment, as much as to say that the mysteries of the craft existed no longer, and that amateurs might all be artists, if they pleased to lay in a stock of the necessary materials. In Mr. Ackermann's department

we were agreeably struck with a very elegant colour-box, made of papier maché.

The above flying notes, though unimportant in themselves, may be interesting some future day, as affording a notion of the position held by the Fine Arts in the Great Exhibition of Industry of All Nations of 1851.

CHAPTER XV.

CUTLERY—*From the Juries' Report.*

VARIOUS CONTRIBUTIONS— ENGLAND — FRANCE — BELGIUM— THE ZOLLVEREIN—AUSTRIA—RUSSIA—SWITZERLAND—SUPERIORITY OF ENGLAND—SHEFFIELD CUTLERY—INDIAN TOOLS —SPAIN— PORTUGAL— TURKEY—EGYPT— TUNIS— CHINA— AMERICA.

It appeared, according to the information laid before the jury, that there were, altogether, about 368 exhibitors in this class, distributed, very unequally, among twenty-two of the geographical divisions contained in the official catalogue. The United Kingdom, as was to be expected, furnished a proportion amounting to not less than forty-five per cent. of the whole list; and among these were to be found many contributors, on so extensive and varied a scale, that its share in the total display of these articles was much larger than the above numbers would imply. The second place was occupied by Austria, whose exhibitors constituted twenty-seven per cent. of the entire sum. After her the Zollverein States of Germany furnished about eight per cent., France about three per cent., Sweden and Norway in nearly the same proportion. A very small number of exhibitors from the remaining countries completed the list, though some of these national collections, however confined to few individuals, contained objects well worthy of attention.

These results must not be taken as any certain indication of the comparative proficiency of the respective countries in the production of commodities of this kind, or of the value of their contributions. It is probable that, in some degree, they might have shown the character and nature of the manufacture as carried on in these different states, and corresponded with its subdivision among more or less numerous hands in comparison with its total extent. In Austria, for instance, we found by the catalogue, that the collections specified as assignable to each exhibitor consisted, for the most part, of one kind of manufactured article, scarcely any of more than two or three; and we might, therefore, perhaps venture to infer that the high number of these, as compared with some departments where they were individually more comprehensive, arose from a very different distribution of capital among their separate establishments in this branch of industry.

But this is not to be considered as a disparagement to their contributions. Such a condition of the manufacture may be best adapted to the supply of the particular demand for which it exists; and, as regards the late Exhbition, even apart from such considerations, the appearance of a numerous list of exhibitors from any one country might have been reasonably taken as a gratifying evidence of the interest and activity awakened there by the invitation to co-operate in a display of the works of universal industry, and of an active desire to share in its honours.

The characteristics of the different national collections were, however, interesting in more than one point of view. We detected, in various instances, indications of the peculiar condition and habits of the people whence they came, of their social and industrial wants and aims, as well as of their natural or acquired advantages.

In England, the close proximity of coal and iron, together with abundant facilities for converting the latter into steel, gave, at an early epoch, to this branch of its manufactures, remarkable energy and importance. Its steel wares had a wide-spread reputation even in the mid-

dle ages. The authority of Chaucer assures us that, in the fourteenth century, the "Sheffield whittle" was an article of choice estimation; and, within their respective sphere, the blades of Toledo and Damascus were scarcely more valued than the more homely cutlery of England. This pre-eminence, the jury had no hesitation in pronouncing, she retained to a very remarkable degree in the late exhibition; though the general statement must now admit of modification, and it would be untrue and unfair to make it without adding, that she had, in certain branches of the manufacture, some formidable rivals. Still, the long-established trade of this country in steel goods of every description, and her ancient practice of forging them for the supply of all markets, were shown in the great variety, as well as excellence, of her contributions, which comprised specimens of almost every conceivable article of this description. But in other countries, where the manufacture has been of more recent growth, it is evident that the energies of their artizans have been directed, by a natural consequence, to the production of those particular articles more especially called for by their individual position or exigencies. One of the chief objects of the German Customs' Union, for instance, has been to encourage the supply from their own workshops of those commodities of general and ordinary use, which were formerly in great part derived from importation. From the Zollverein states, accordingly, we found a mixed collection of that character, together with some few objects of the plainer kind for certain foreign markets. From Austria, where the mines and manufactures are in the immediate neighbourhood of a large agricultural and pastoral population, it was observed that the collection consisted chiefly of scythes, sickles, and the simpler implements of husbandry. In Switzerland, the traditional manufacture of fine watch-work renders delicate files a matter of primary necessity, and there was, therefore, a predominance of these among the better articles in that department. The Belgian collection was distinguished

by "spiral cutters" of superior quality, required in the finishing of the woollen fabrics for which that country has long been famous. In France, we of course found a very miscellaneous collection; but it displayed, in a marked manner, productions, indicating on the one hand the highest scale of social civilization and of manufacturing skill in certain spheres and localities; and, on the other, the simplest wants of a primitive provincial population; while in the United States and Canada, where the occupation of the population is an incessant war upon the forest, the manufacture of axes and woodmen's implements assumes an importance which has raised them to the highest perfection, and which rendered this class the most perfect part of the transatlantic exhibition. But it appears advisable to add some more precise notices of the peculiar contents of each national collection; and for this purpose it will be most convenient to take the two great divisions in the order adopted in the official catalogue.

First, then, with respect to the United Kingdom, we found that articles in the class of cutlery and edge-tools had been sent from a great variety of places. In England, from London, Sheffield, Birmingham, Warrington, Stourbridge, and a few other towns of less note; from Glasgow and Edinburgh, but chiefly from the former, in Scotland; and from Cork, Clonmel, and Limerick, in Ireland. Among these seats of the manufacture there was none, as might naturally be expected, which for extent, variety, and excellence of collection, could compare with Sheffield—its most ancient home. We here found every article, from the most exquisite razor down to the plainest pocket-knife, and from the finest saw or file to the most ordinary chisel displayed—with various degrees of merit, it is true, but with a large proportion of the highest. From this collection, the jury thought themselves justified in awarding, for one remarkable object, a council medal. Messrs. Spear and Jackson exhibited, among an assortment of edge-tools of great excellence, a cast-steel circular saw, of the large size of five feet diameter, and of such signal beauty and per-

fection, that it stood far above comparison with any other in the building. The mere excellence of its quality and workmanship, however, would not, the jury declared, have enabled them to distinguish it by a council medal, if they had not been able to satisfy themselves that its merit was the result of a new and peculiar process of manufacture. But they entertained no doubt, from the information they received, that mechanical ingenuity of a novel and special character had been employed by these manufacturers for the production of such articles, without which they could not have been carried to equal perfection; and they therefore considered them justly entitled to the highest mark of distinction.

There were two other contributions to which the jury would have felt themselves called upon to award a similar honour, if they had been at liberty to regard singular excellence of workmanship and quality as of itself a sufficient title. Messrs. Turton and Sons, of Sheffield, and Messrs. Stubbs, of Warrington, each displayed a complete assortment of files of various sizes—the former for ordinary manufacturing purposes; the latter for the finer operations of the watchmaker—which, the one for large dimensions, and the other for minute delicacy, combined with the utmost strength and efficiency of material, far surpassed any other objects of the same class. They would have deserved the highest assignable reward in respect of these points of merit. Prize medals, however, were awarded to them in common with a number of associates not unworthy of their company. It will be found that the list of these contains a series of names of which many are of high note in the estimation of the public, and whose contributions—some extensive, and comprising, in a high degree, almost every variety of excellence, others limited, but of marked merit throughout—displayed the choicest productions in the most finished cutlery, and the finest mechanical tools.

The attention of the jury was particularly called to one novelty exhibited by Messrs. Blake and Parkin, of Shef-

field, consisting of the union of two qualities of cast steel, hard and soft, in the same article; having carefully examined these specimens, which were manufactured with much skill, they saw no reason to doubt that the process was peculiar to the exhibitors; but they could not satisfy themselves that it involved any clear advantage over the combinations of cast and bar steel, and of cast steel and iron, the methods of cementing which have been long known and practised.

The contribution from London was, of course, on a more limited scale than that from Sheffield; but it consisted of that superior order of cutlery for which the metropolis has a long-established reputation, and contained articles of high merit in this class. Among the exhibitors from London, Mr. Durham, of Oxford-street, would have been considered by his colleagues deserving of a prize medal, if his consent to act as a juror had not disqualified him from accepting it. The finer descriptions of cutlery were nearly confined, in England, to the Sheffield and London departments; but there were a few articles contributed by individual manufacturers from other places, whose names may be found in the award list; and there were some also furnished from Ireland and Scotland, which, though not equal to the best from the chief seats of the manufacture, were still of considerable excellence.

Manufacturing tools were supplied largely from Birmingham, and sparingly from Scotland; scythes and files from Stourbridge and Warrington; which latter place furnished the beautiful collection of watch-files by Messrs. Stubbs, already mentioned. On the whole, it appeared that the British manufacture of cutlery remains still, as heretofore, mainly seated at Sheffield, though it has been established also, to a limited extent, in some other quarters. The same gradual change of circumstances which has operated to transfer, in a great degree, the silk and some other trades from London to the provinces, has had the effect of withdrawing much of this branch of industry from the capital; though a portion, chiefly directed to the

production of the higher order of articles, still retains its footing there, and sustains its reputation. On the other hand, the manufacture of the coarser goods, such as tools and mechanical implements, is now extensively shared by several localities which afford the requisite facilities for its successful prosecution, and where the various other forms of industry which surround it create a continued demand for its productions.

Extending our survey beyond the limits of the United Kingdom, from its provinces to its dependencies, it was found that these presented aspects so very different, that certain distinctions were indispensable, with reference to a proper estimate of their position as exhibitors. It is not to be expected that in infant communities, such as most of the colonies, properly so called, a manufacture of this kind could have attained any considerable growth or perfection, though the greater progress and development of some few have enabled them to meet their peculiar local exigencies with considerable success. We found in this category a small contribution from the Cape of Good Hope, by the missionary station at Gnathendal, consisting of various forms of knives adapted to the uses of that country; and from Nova Scotia another, of cutlery made of Nova Scotia steel, though manufactured in Sheffield. Both were creditable to these colonies—while from Canada (West) there was a larger assortment, consisting entirely of axes and tools, the former especially of excellent quality, and proving the skill and power of her artisans to supply those particular articles to which her physical exigencies give the highest importance.

On the other hand, there were contributions from dependencies which are to be considered in a very different light, not newly-peopled, but ancient communities, variously advanced in civilisation, and having their own established and characteristic industrial pursuits, often of the highest order of manual dexterity. In this division there were some from the vast territories of the East India Company, which well deserved notice; and a small con-

tribution from Jersey. The Indian department contained various Hindoo and Malay tools for the use of carpenters and workers in metals; and among them were found, from Moorshedabad, in Bengal, a set of the implements employed by the native artificers in carving the beautiful ivory articles which have so long been admired in the western world, and which present such rare examples of ingenuity, taste, and skill. Articles of this kind, however, are of so peculiar a nature, and of so limited an application, that they can scarcely be considered as bringing into play any principle of general competition or comparison. It is not so with the foreign neighbours of Great Britain, whose productions come next under notice. They will be found to extend, with various degrees of excellence, through all the class of commodities which proceed from the workshops of the United Kingdom, and to include some, also, of a peculiar and distinctive character.

Looking first to Europe, its foreign exhibitors might have been classed under certain great subdivisions, naturally suggested by the position and relations of its different members, and necessary to the clearness and convenience of the survey. Thus the several national departments contained in the total list might have been advantageously connected as follows:—

1. France, Belgium, and Switzerland. 2. Austria and the southern states of Germany. 3. The Zollverein and northern states. 4. Denmark, Sweden, and Norway. 5. Russia. 6. Spain and Portugal. 7. Turkey, Egypt, and Tunis. 8. China. 9. The United States of America, to complete the distribution over the remainder of the world.

1. From France there was an extensive assortment, ranging from the finest ornamental cutlery down to the rudest and cheapest articles for domestic use, which in general character was very good, and in some instances of superior quality. The greater portion appeared to be supplied from Paris; but there were a few exhibitors also from the provinces—from Moulins (an ancient seat of this

manufacture), from St. Etienne, and from places in the districts bordering on the Rhine.

In cutlery, the best specimens were those of razors, pen-knives, scissors, and table-knives, many of which were very highly finished and elaborately ornamented, and displayed great skill as well as superior quality. Among the tools and implements were to be found a very excellent circular saw, showing high proficiency in this branch of the manufacture, and assortments of files, also of considerable merit as to workmanship, though found, after a careful trial, to be not quite perfect as to the quality of the steel. On the other hand, we may mention particularly the samples of "web-saws," which were of the very highest class, and, indeed, superior to anything of the same description contained in the English collection. Belgium supplied cutlery, together with files, scythes, "ledger blades," and "spiral cutters." These last articles are portions of the machinery used in the dressing of cloth, and were of a high degree of merit. The cutlery, principally of the table kind, was well finished, but the metal was somewhat soft, and unequal to the workmanship. The same must be said of the scythes and files. From Switzerland, the articles consisted mainly of razors, and of small files adapted to the use of the watchmaker. The former were of fair quality; the latter of the most delicate workmanship, and well suited to the trade for which they were designed, and which has been long successfully pursued in that country.

The attention of the jury was called, in the French department, to a collection of articles, as examples of remarkable cheapness, which they would not have deemed worthy of mention on any other grounds. These were a certain description of extremely rude pocket-knife, said to be in very universal use amongst the peasantry of France, for cutting their provisions and other purposes. They are formed of a rough blade of soft iron, folding into an equally rough turned cylindrical handle of wood. It is obvious that, with such materials, their utility must be

very limited; but they are sold for five centimes, or about one halfpenny each, and are therefore in general use among the poorer classes.

In France, Belgium, and Switzerland, the manufacture of cutlery and edge-tools has greatly improved, and seems likely to continue to do so.

2. Of the sub-division of states, which we have placed next in order, the same improvement was, to a considerable extent, observed. Including therein Austria, Wurtemberg, and Saxony, we found that the two latter, at least, exhibited specimens of general knife cutlery, and of hunting-knives, which, though they could not be pronounced equal to the best English, were of very good quality, well finished (especially in the Saxon portion), and mounted with much costly ornament. From Austria the display was not of so high a class; the cutlery from that country was of a very ordinary description, chiefly the produce of Styria, and was stated to be exhibited, in a great measure, as an example of cheapness. After such consideration, however, as the jury had the means of giving to this point, they concluded that the price was not below what goods of the same quality might be produced for in other countries. The articles were very deficient in merit of any other kind, many of them not even being of steel.

These remarks apply in a great measure to the tools and implements in this department. There were some from Wurtemberg of fair quality; but the assortments of files and other such objects from Austria were indifferent, and not, apparently, very low in price. There was here, however, one description of article deserving of notice, as a curious example of the modification which all tests of merit must undergo when judged by the peculiar uses for which the production is designed. We allude to assortments of scythes, from the southern provinces of Austria, worked thin, and with a concave surface, very difficult to forge, and therefore requiring much skill in the workmanship, but of metal so soft and inferior, that they would not have been considered worthy of any notice were it not

that they are so made purposely to suit the particular habits of an agricultural population, who mow all crops, whether of grain or others, close to the surface of a soil generally abounding in stones. A scythe of hard steel, with a fine edge, though it might perform its work better where unimpeded, would be liable to constant injury, very difficult of repair, under such circumstances; whereas these Tyrolese or Styrian scythes yield at once to the blows which they receive upon their edge. The labourer carries with him a small hammer; and whenever the blade has so far lost its shape as to need renewal, he beats it out in a few moments to its original form; hence the softness of the metal, in most cases considered wholly inconsistent with excellence in this branch of manufacture, becomes an essential property.

3. From the States of the Zollverein, and from Hamburg and Mecklenburg-Schwerin, in Northern Germany, there was a collection of articles of almost every description. The two latter States contributed only on a limited scale; Mecklenburg some razors, and Hamburg also, together with a small collection of tools, of fair quality. The former commodities were not good of their kind, and those from Mecklenburg apparently very high in price. Of the cutlery from the Zollverein, much, though highly finished, was of an ordinary description, consisting of table and pocket knives in considerable variety; but there were also certain "spear knives," designed for fishing by the natives in the South American rivers, and adapted for their markets, which deserved notice as of superior manufacture. Among the tools the same character prevailed as in the cutlery, though there were certain "web-saws" which evinced higher skill. There was an assortment of scissors, chiefly from Solingen in West Prussia, worthy of attention as being manufactured in great numbers from an ore producing a "natural steel," which is of such quality as to suffice for the purpose to which it was here applied, and to save the manufacturer the cost and labour of the converting process, thereby enabling him to produce

such goods at a price much lower than would be profitable with the ordinary methods. The workmanship of these scissors appeared to be fair; but the jury were unable, after much attention to the point, assisted by the judgment of Mr. Ragg, an experienced workman, to satisfy themselves entirely as to the real quality of the metal, although the material from which they were said to be manufactured had been examined by Mr. Henry, and was pronounced by him to be steel.

4. The collections from Denmark, Sweden, and Norway were small, and contained little that required notice. From the two latter countries the number of exhibitors bore a large proportion to the extent of the contributions, indicating establishments on a very limited scale; and although Sweden has long produced the most valuable iron, as the raw material of the finest steel and of the most finished cutlery, it does not appear that the manufacture itself has made any great advance. The collection consisted of some razors, spring-knives, and other cutlery tools of an ordinary kind. From Denmark there was one singular article, a set of files, hollowed, and made to fit within each other: they were curious, and difficult of manufacture, but of no apparent utility.

5. Of the three contributions from Russia, one only was from a private individual, the other two were from imperial establishments. The former contributed a varied assortment of cutlery of all kinds, and of fair quality; the latter some tools, which could not be ranked very high, and some scythes of the same kind as those whose peculiarities were described in the Austrian department. The Russian implements of this description were the best.

6. From Spain and Portugal the contributions were very small. The former exhibited only an assortment of files from Placenzia, of very fair quality; the latter, some "agricultural implements," consisting of pruning-knives and scissors, probably adapted to the vine cultivation, but of little merit as manufactured goods.

7. Of the three States in the next division, Turkey,

Egypt, and Tunis, the two latter were only slender contributors in this class. One or two articles contained in the list furnished by the Egyptian government, and a few pairs of Tunisian scissors of the roughest workmanship, constituted the entire collections. Turkey, however, appeared with articles of greater interest, such as scissors and hunting-knives, few in number, but well made. The knives had blades of Damascus steel; the scissors were of a singular form, and well deserved notice. They were so fashioned that each blade was half of a hollow cone, and the two therefore produced an entire cone when closed. The sides of each of these halves formed the cutting edges. They were well finished, and must have required much skill and great labour in their fabrication, rendering their cost high; but it did not appear that they possessed any superior utility. It was not stated that they were so made for any special purpose; and, if not, they involve considerable waste of toil and skill.

8. From China there were only a very few articles; but one of them was a singular instrument, and should be noticed, as characteristic of the people from whose workshops it proceeded. It was a small blade of a triangular form, $2\frac{1}{2}$-in. long, $1\frac{1}{4}$-in. wide, and $\frac{1}{4}$-in. thick, folding upon a slender wooden cylindrical handle, and was used as a razor for shaving a part of the head, according to general practice among the Chinese. It is not easy for us to comprehend how the operation can be successfully performed with such an implement; but it is said to be in common use among the natives, and to effect its purpose in their hands with the utmost nicety and dispatch, and it cannot, therefore, be ill-adapted to its object. The workmanship was, to European eyes, of a very rude description, and even the surface of the metal displayed none of the finish which was so diligently bestowed on many Chinese productions; but the edge it carried was certainly good, and its quality, no doubt, surpassed its appearance.

9. Lastly, the opposite hemisphere supplied, from the

United States of America, a collection which, though not very extensive, contained some signal proofs of proficiency in such manufactures, and was strongly characteristic of the natural and social exigencies of the people from whom it came. It consisted of a few articles of the finer cutlery, but mainly of assortments of the larger edge-tools and implements, such as scythes and axes, and other objects of that nature. The former were finished with great care, and decorated with much costly ornament; but the jury could not pronounce them to be of the first degree of excellence in workmanship, and their temper was wanting in the hardness proper to the best cutlery. With respect to the other articles, however, the case was different. There was a set of joiner's tools, which, though few in number, were excellent; and the same might be said of the scythes, which were of the best quality. Good as these productions were, they were, perhaps, surpassed by the axes, to which nothing of the kind could be superior. They were admirably finished, and at the same time displayed all those more valuable qualities which are the necessary conditions and evidence of perfection in such commodities. It was evident that the great prevailing want of the population had created and encouraged to perfection, in its own neighbourhood, the trade which was to supply it. The jury believe, that in the above general survey of the contributions presented by this class of the Exhibition, they have left nothing unmentioned of any note or merit.

CHAPTER XVI.

HARDWARE.

PINS, EDDELSTON AND WILLIAMS—KIRBY, BEARD AND CO.—GOODMAN, ETC.—SHEFFIELD MANUFACTURES—SPRING KNIVES, ETC.—BRILLIANT TROPHY—GAS BURNERS, STOVES, ETC.—ELECTRO-PLATING—METALLIC PENS—BUTTONS.

THE limits assigned to the display of articles of hardware were necessarily occupied by an extensive and miscellaneous collection, embracing the most minute as well as the most gigantic of manufactured articles; from the delicately-formed tiny ribbon pin, to the ponderous and unwieldy anchor; from the commonest implement of domestic utility, to the monster engine of destruction, the enormous cannon exhibited by the Low Moor ironworks. What wonders might there not be revealed, had we time for entering minutely into the subject, in the description of the various modes of manufacture, and the no less various uses of the numerous articles that were ranged under the title of this chapter? We shall briefly notice a few of the most serviceable appliances to the requirements of civilised man; and, as "*ex pede Herculem*" is our motto, for the present we shall commence with the apparently insignificant article of "pins," as illustrated in the Great Industrial Exhibition of 1851. The number of exhibitors of pins was very limited. In the Birmingham compartment there were but two—Messrs. Eddelston and Williams, and Mr. Goodman; Messrs. Kirby, Beard, and Co., exhibiting in the north transept gallery: and it was a matter of regret that in the machinery department none of the mechanism by which pins are made was exhibited. After examining the finish and form of the pins in the collection of Messrs. Eddelston and Williams, we cannot avoid being struck with the immense advance which must have been made since the time of Queen Elizabeth, when

wooden skewers formed an indispensable adjunct to her Majesty's toilet table. Even during the last twenty years the improvements have been very considerable. Previously to that time the head of the pin consisted of a spiral ring of wire, placed upon the shank or shaft of the pin, and fastened to it by blows of the hammer. The inconvenience which resulted from the heads becoming loose led to the adoption of a plan, now very general, for making pins with solid heads. Messrs. Eddelston and Co. exhibited a series of examples, showing the various processes which a pin undergoes in its progress towards completion. We first saw a small block of copper and one of spelter; next to these there was a block of brass, formed of the union of those two metals. These blocks were then shown cut into smaller flat strips—then partially drawn—and finally drawn out into different thicknesses of wire. The wire was next seen cut into the required lengths, in the form of "pin blanks"—afterwards "pointed" and "headed"—and finally, the silvered or finished pin. A pair of dies and a punch, used in forming the head of the pin, were also shown. By means of this instrument or machine the pin was formed, complete with the head and shaft, out of one solid piece of wire, instead of by the old process of the wire heads. The solid-headed pin was invented by Messrs. Taylor and Co. about twenty years since, and was patented by them, but the patent has now expired. In order to produce the head, the shaft of the pin is cut a trifle longer than the finished pin is required to be made. The wire thus cut passes into a mould of the exact length of the pin, and the end of the wire projecting beyond the length of the mould, is by a sharp blow flattened, and shaped into the form required for the head. The heads are afterwards burnished, an operation which adds greatly to their finished appearance. The finished pins we observed were most tastefully arranged around a centre, being of all sizes, from the large blanket pin, of three inches in lengths to the smallest ribbon pin used by the ribbon manufacturers, of which 300,000 weigh only one pound. The col-

lection of insect pins used by entomologists was worthy of attention, as showing what minute specimens may be produced by the aid of machinery. They are made of much finer wire than the ordinary pin, and vary in length from two to three inches to a size considerably smaller than the tiny ribbon pin. Some smooth elastic hair pins, highly approved of by the fair sex, and of which some tons weight are annually made by Messrs. Eddelston, were also shown in their case. The smoothness of the wire, and its fineness and elasticity, are certainly most surprising. In connection with the manufacture of the solid-headed pins it is a curious fact, that although so vastly superior to the old-fashioned pin, they are produced at a considerably less price, in consequence of the great perfection of the machinery employed. In addition to the improvements made in the heads, machines have recently been constructed by the firm, each of which is capable of pointing pins at the rate of upwards of six hundred per minute. These and various other improvements in the process of manufacture enable the makers to sell the great majority of the pins at the merest trifle over and above the cost of the raw metal; a large number of the pins manufactured being sold at not more than twopence per pound over the cost of the metal of which they are formed. Upwards of 200 hands are constantly employed by Messrs. Eddelston in this branch of manufacture; and the number of pins made by them is, in consequence of the improved machinery, more than three times that which could be produced by the same number of workmen only a few years since. Upwards of 150 tons weight of copper and spelter are annually worked up into pins by this one Birmingham house alone. Were the whole of the metal which is worked up during the year, in this one manufactory, converted into ribbon-pins, half an inch in length, it would produce the enormous number of 100,800,000,000, or about 100 to each inhabitant of the globe. If placed in a straight line, they would be 787,500 miles in length, or sufficient to extend upwards of thirty times round the

globe, or more than three times the distance of the moon from the earth. Some idea may be formed from these figures, not only of the extraordinary malleability of the metal, but of the astonishing consumption of the articles formed from it. Indeed, we can scarcely conceive any question more completely unanswerable than that of "What becomes of all the pins made?"

Messrs. Kirby, Beard, and Co. made an interesting display of pins in their stand; the back of which was ornamented with the words "Peace and Industry," and with various other decorations produced in steel beads, closely imitating the heads of pins. In the case itself were shown the pins in various stages of progress, and a large assortment of "toilet," "hatters'," "jet," "ribbon," and "milliners'" pins.

Mr. Goodman, of Birmingham, and Mr. Chambers and Mr. James, of Redditch, also exhibited a variety of pins, which, so far as we were enabled to judge of them in the case, were well-finished specimens. In the machinery department was shown an ingenious and interesting machine, by Mr. Iles, of Bardesley Works, Birmingham, used for sticking pins in circular tablets. We may add that Messrs. Eddelston and Co. have since constructed a machine, by which they are enabled to stick the pins upon the papers upon which they are sold, and which performs its work with marvellous rapidity and accuracy.

M. Reineker, of Cologne, in the Zollverein division, showed several varieties of pins: some with composition metal heads, cast in the same mode as shot, with a hole in the centre and secured to the shaft. Samples of iron wire in hanks with a coating of copper, were also shown in the neighbourhood of the finished article. The pin manufacture of Austria was represented by M. Struntz, of Vienna; and M. Vantillard, of Mérouvel, France, showed some specimens of iron pins, tinned by a process recently patented both in France and England.

Sheffield Manufactures.—The conversion of iron into steel, (to the extent of many thousand tons annually,) is

the principal manufacture of Sheffield; and the several processes of cementation, blistering, shearing, casting, tilting, and tempering, were illustrated by specimens in the Exhibition. Thus Messrs. Johnson, Cammell and Co., of the Cyclops Works, exhibited progressive specimens, from the imported iron up to the most refined state of the metal—in the varieties of "cemented blister," "double-refined cast," "double-shear," or "elastic spring." Their display of tools included their "curvilinear tanged file;" and their "continuous tooth concave and convex file;" the latter rewarded by a medal from the Society of Arts. The careful finish of their work was also shown in their springs for railway carriages; and in a piston-rod, weighing 16 cwt., the finest and largest piece of steel in the Exhibition. Another assortment, forwarded by Turton and Son, illustrated steel manufacture from Swedish bar-iron. The same firm contributed a steel ingot, weighing upwards of 1 ton 4 cwt., intended for one of a pair of piston-rods for a marine engine. It consisted of the contents of 48 crucibles, each charged twice with 80lb. weight of steel; the operation was performed by forty work-people, and the pouring of the melted liquid steel into the mould was accomplished by three men in eight minutes.

Messrs. Turner and Co. displayed a pair of Albert venison-carvers, with stag antlers; and the Prince of Wales's sailor's knife. We must not, however, omit to record a brilliant trophy of Sheffield cutlery, which was arranged in a case in the western nave of the building. It contained 230 pairs of scissors, of every size and pattern, grouped and mounted upon a white ground; the centre object being a pair of huge scissors, twenty-two inches long, the bows and shanks representing in outline two crowns; the upper one surmounted by a thistle: all the ornamental work was wrought with the file, some portions of the surface being chased. This object was by far the most expensive pair of scissors ever produced in Sheffield. On each side of this appeared another pair, nearly the same size, and scarcely less beautiful or costly. One pair represented, in

chasing, the bruising of the serpent's head; in the centre was wrought out with the file the Prince of Wales's feathers; and the bow was the shamrock, rose, and thistle, and scroll-work—all wrought out with the file. Next was illustrated the scissors' manufacture, in its ten stages. Among the most striking specimens was a pair of 16-inch fancy nail-scissors, ornamented with etching; a group of surgeon's scissors, curved, angular, and distorted for difficult operations: a sportsman's knife, containing eighty blades, and other instruments; also one three-quarters of an inch long, with fifty-one blades and other instruments; and a case containing twelve perfect pairs of scissors, yet so small that they did not weigh half a grain.

Another striking feature was the variety of stoves; register and air, cooking and gas, heat-reflecting, smoke-curing, &c.

Among the gas-burners exhibited was the self-regulating apparatus, by Mr. Biddell, who introduced into the centre of the burner a vertical compound rod of about a quarter of an inch in diameter, the cylindrical case being of brass, and the core within of steel. By the expansion and contraction of this rod, which is surrounded by the flame, a small lever and simple valve, in connection with the bottom of the rod, are acted upon so delicately, that the exact amount of gas required to preserve uniformity of flame is preserved.

One exhibitor, who had great faith in a new name, sent a saucepan with a false bottom, upon which, potatoes being placed, covered up, and set upon the fire, steam was generated, and thus the potatoes were cooked in the water they contained—a contrivance called the *Anhydrohepsetereon.*

Dr. Arnott's stoves and ventilating apparatus were exhibited: with Peirce's pyro-pneumatic stove, made of fire-clay in pieces, through which are air-keys, the whole cased with iron; an open fire warms the fire-bricks, the passages between which are connected with a pipe leading to the external air, when the warmed air rises into the apartments, and a supply of fresh air is obtained from

without. Edwards's patent *Atmopyre* was shown: it consists of a porcelain chamber; within it is the gas fire, which escapes through minute perforations; the mass thus becomes red hot, or, in the words of the patentee, "solid gas fire" cooking stove. Several gas meters were also shown here. The stove-grates tastefully displayed painted china and ormolu, encaustic tiles, gold medallions and scrollwork, marble and alabaster; and we learn from Mr. Hunt's excellent *Hand-Book*, that seven of these grates and six fenders had been designed by pupils of the government school. The fire-irons and fenders were also of corresponding elegance.

There were several specimens of patent wire ropes exhibited by Messrs. Newall; and of flat chains with wooden keys, for collieries, by Mr. Edge. Messrs. Henn and Bradley supplied a good assortment of their crown-tapered screws, of the most delicate structure, for pianofortes, as well as for the heaviest railway purposes.

Sheffield Plating.—Although the electro-plating process is extensively applied, Mr. J. G. A. Creswick, of Sheffield, states, in a letter to the *Times*, that the old and substantial method of plating on the ingot by fire is still employed in that town, and is almost entirely used in articles for the London trade—such as dishes and covers, tea-sets, candelabra, &c.; and in many cases such goods (made by the first class of the Sheffield manufacturers) have stood the wear of from twenty to thirty years' use. Mr. John Gray, of Billiter-square, exhibited a series of articles illustrative of this method of plating, commencing from the ingot and terminating in the finished article. The ingot is composed of copper alloyed with other metal, so as to impart to it the necessary roughness and rigidity. The plate of silver is tied upon its polished surface with wire, and the combined metals are then heated in a furnace, till both bodies are in a molten state, and thus become most effectually united. After this process, the two metals united form an ingot, which is subjected to rolling and hammering into form—which test the electro process

never subjects articles to, as they are all coated after the goods are finished, so far as manipulation and annealing is concerned. Soldering the silver upon any baser metal is only practised in making cutlery, and does not at all apply to plated manufacture, being a distinct branch of business. Mr. Gray also exhibited an ingot of copper, previous to this process, with the plate of silver tied upon it with wire; ingots of copper and white metal after the silver plate has been united to them by an elevation of temperature only; and a sheet of plated metal, rolled from a plated ingot. A table-dish, made from the rolled metal, was the next in the series, with the silver mountings laid upon it, but not yet soldered. The steel dyes in which the silver mountings are struck together, with the mountings produced by them, were also shown; in fine, the table-dish was exhibited in its finished state, as well as a specimen of a salver likewise produced by this manufacturer.

Metallic Pens.—A steel pen is as great a wonder of the present day as a pin was to our ancestors. Large black and red pens were made of steel early in the present century; but the extensive introduction of steel pens dates from 1828, when Mr. Gillott, of Birmingham, patented a machine for making them; and 1830, when Mr. Perry, of London, added to their flexibility "by apertures between the shoulder and the point." About the years 1820 and 1821, the first gross of three-slit pens was sold wholesale at 7*l.* 4*s.* the gross; the cheapest pens are now sold at *twopence* the gross, and the price rises with the elasticity and finish of the pen up to 3*s.* 6*d.* and 5*s.* the gross. Nearly 150 tons of steel are stated to be now annually made into pens; and, in one Birmingham establishment, 500 hands are daily employed. Here is an outline of the several stages of the manufacture. The rolled sheet steel being received from Sheffield, is cut into strips, put into cast-iron boxes and softened by heat, and rolled between metal cylinders to the required thickness. The steel is then passed to a woman, who, with a hand-press, cuts out

at a single blow the future pen; and a good hand will cut 28,000 per day of ten hours. The central hole and side slits are cut by another press; the semi-pens are then softened by heat, by a die worked by the foot—are stamped with the maker's name, and then by a machine pressed into a cylindrical form. The pens are again heated, and then thrown into oil, which makes them very brittle; but they are cleansed and restored to elasticity by placing them in a tin cylinder, turned over a fire, like a coffee-roaster; the pens are next scoured with sawdust, in cans placed in a frame which revolves by steam. Each pen is then ground at the back, in two ways, at right angles to each other, or rather over each other; the girl holding the pen with nippers for a moment on a revolving "bob." The pens are then slit with a tool very nicely fitted into a hand-press, turned by a handle. They are then examined and sorted; and lastly, varnished with lac, dissolved in naptha, evaporated by heat. Messrs. Gillott's specimens ranged from a monster pen, weighing five pounds, and measuring one yard in length, to a Lilliputian weighing four grains; the monster containing metal enough to make 1,092,327 of the tiny ones: the colouring of the metal was very rich. In a glass case, too, the whole history of the manufacture was wonderfully told. In an adjoining case, by Wiley and Co., were shown silver and gold pens, some tipped with iridium and osmium, the hardest of known metals; and in Hinckes and Co.'s case was a series of nut-shells, each containing an incredible number of infinitesimal pens of great finish, which it required a microscope properly to appreciate. Messrs. Perry also exhibited some fine specimens.

Buttons.—The oldest of the Birmingham buttons seem to have been a plain flat button, of the waistcoat size, which, a hundred years ago, was sold at 4*s.* 6*d.* a gross, and which is still manufactured at 1*s.* 6*d.* a gross. Then came a very large button, of the size of half-a crown, with ornamental devices on it; but this was dear. It was the gilt and plated button, introduced between 1797 and

1800, which made the great "hit" in the trade. This button became immediately fashionable, and continued so for a quarter of a century. Everybody must remember the days when the blue coat, with its seemly array of glittering brass buttons, was the not unbecoming garb of a gentleman. At the end of twenty-five years, it was pushed from its popularity by the covered, or Florentine button; but some years ago a dashing attempt was made to revive its glories by means of a deputation which the trade despatched to London. We do not learn that they committed a similar inadventure to that of the poor wig-makers, who went up to petition the throne, some years previously, against the practice of wearing one's own hair—but, going in their own natural hair, so scandalised the mob by their inconsistency, that they had it all cut off for them by the rabble. Armed with sets of beautiful bright buttons, the discomfited makers forced their way to the foot of the throne, and, tendering their article, besought royalty to pity their misfortunes. They represented that the old button was very handsome, and that thousands were reduced to poverty by the introduction of the new one; and they therefore entreated the king (George IV.) to encourage the metal button made by wearing that article. The same appeal was made to other influential persons; and not only the king, but the Duke of Clarence, several of the ministers, many members of the nobility, the Lord Mayor, and other notables, accepted the proffered buttons, and promised to wear them. The experiment was successful; a reaction took place, and the dark button, as we well remember, went aside for a few seasons. Again we all came out glittering—

"To midnight dances and the public show."

But the triumph was not long; and that it was not longer was the fault of the Birmingham people themselves. Some manufacturer invented or introduced a cheap method of gilding the buttons. The trade called it French gilding, the workmen named it "slap-dash." It

made the buttons look remarkably brilliant for a very little while, but they tarnished almost immediately, even before the retailers could sell them; and if placed in all their brightness on a new coat, they looked shabby in a fortnight. This discovery—perhaps it is refining too much to suppose that it was introduced by a friend to the Florentine button—fatally and finally damaged the metallic cause, by casting discredit upon the whole manufacture: people left off ordering brass buttons, and by 1840 the trade was again ruined. A second attempt at obtaining illustrious intervention was made: Prince Albert was assailed by a deputation, and the sympathies of the press were invoked by the metal buttonist. But the charm would not work twice, and you never see a gilt button now except upon the terribly high-collared coat of some terribly devoted adherent to old fashions, who may be observed nestling in the corner of the stage box on first nights, and who, if he speaks to you, is sure to growl out the unreasonable intimation, that "You ought to have seen Joe Munden, sir, in a character like this. Munden, sir, *was* an actor. Except the buttons required for the military and naval services, and for "Jeames," the metal article is out of date, and covered buttons have it all their own way. The Florentine or covered button was first introduced into Birmingham in 1820, and it derives its name from the Florentine cloth with which it is covered. It is composed of five pieces: first, the cover of Florentine cloth or silk; second, a disc of metal, which gives the shape to the button; third, a somewhat smaller disc of brown pasteboard or wadding; fourth, a disc of coarse black linen or calico; and fifth, a disc of metal, from which an inner circle has been punched out, so that the cloth or calico above may slightly protrude, and form a shank of the button. Young girls cut the various discs with a punching machine, and the last operation is to place the five pieces in regular order in a small machine constructed to hold them—an arrangement carried out by a number of little children under a woman's superintendence; and

then this machine, which has been compared to a dice-box, is brought under a press, which, with a touch, fastens the whole bottom together with a neatness and a completeness to which any one who will examine his coat-button can be witness.

Horn buttons are made from the hoofs of horned cattle: those of horses are not available for the purpose. The hoofs are boiled until soft, and cut into halves; then "blanks" are punched out. The blanks are placed in vats containing a strong dye, red, green, or black, and the shank is next fixed in. The button is then placed in a mould, where the under surface is stamped with the maker's name. A dozen moulds are put into an iron box, and heated over an oven until the horn is as soft as wax, and then an upper mould with the pattern for the top of the button is pressed down, fitting close to the lower mould. The moulds having been placed in the press, and submitted to its action, the buttons are complete, except that the rough edges require paring. Brushes, worked by steam, then run over and polish the buttons, and they are ready for the sorter. There were numerous beautiful specimens of these buttons in the cases to which we shall presently refer. There are still many other kinds of buttons to be noted. The pearl button gives employment to 2,000 people in Birmingham alone.

We must not forget glass buttons, with which it was lately the pleasure of admiring mothers to sprinkle their little boys very profusely, and which are also much in demand for exportation to the African chiefs, who have the true barbarian love of glitter. There are two sorts, the round and the knob-shaped. The former are made of sheet glass, of various colours, and coated with lead, which is cut by hand into small squares, the corners of which are rounded with scissors, and the edges are ground on a wheel. The shank is then fastened; it is joined to a round piece of zinc, the size of the button, and soldered to it. The knob buttons are made in a mould: a long rod of glass being softened in a furnace and clasped in the

mould, in which the shank has previously been fitted. The black glass buttons, for coat-links, are made at a lathe. Agate, cornelian, and stone buttons are imported from Bohemia, and shanked and finished in Birmingham. There were several other kinds of buttons, as the iron and brass buttons with four holes, used for trowsers, steel buttons for ladies' dresses, wooden buttons and bone buttons for under clothing. The former are punched by one press, rendered concave by another, and pierced by a third, and then a hand-piercer is introduced from the opposite side to that which receives the blow, in order to smooth the edges of the holes. Having been cleaned, the buttons receive a white coating, by means of a chemical process. The steel buttons are made by the steel toy manufacturers. The wood buttons are made by wood turners; and the bone buttons are chiefly made by the horn button makers.

Having thus enumerated the principal forms of buttons, we will pass in review some of the specimens exhibited. Messrs. Twigg had some very handsome specimens of the "Jeames" button, and some boldly embossed naval buttons, with appropriate ornament. Some of their cut-glass buttons in metal were effective. Messrs. Pigott's bronzed buttons, with sporting subjects, were among the best we have ever seen: and Messrs. Hammond had some particularly bold and well-executed device-buttons — a set which we noticed, as made for a "curling club," being very characteristic. Messrs. Aston not only showed a handsome assortment of all kinds, especially of the Florentine class, but they introduced a series designed to illustrate their manufacture—a course which was very much in conformity with the spirit of the Exhibition, and one which we could wish had been adopted wherever it was conveniently practicable. Messrs. Inman had also some bold and well-executed buttons, some of them honoured with the episcopal *insignia*, and others for the servants of the London Docks. Some of the prettiest cut-glass buttons

in the Exhibition were those of Messrs. Neal and Tonks; and Messrs. Chatwin's case contained as highly-finished specimens as any assortment around them. In connexion with Mr. Banks's buttons, we observed some large and fine specimens of the shells used in the manufacture of pearl-buttons, above described, which were brought from the Gulf of Persia, and from the Sooloo Isles. A very small but pretty contribution was made by Mr. Knowles, consisting of gold plated and enamelled buttons: there were, we think, about a dozen only. Mr. Wells exhibited some horn buttons of considerable merit. A case contributed by Messrs. Smith, Kemp, and Wright, showed us a very brilliant assortment. The sporting buttons, representing the neck-and-neck end of a race, the hunter clearing a hedge, the sportsman bringing down his partridge, with other varieties of amusements, were very cleverly designed. There was a good St. George and the dragon, and indeed a very rich multiplicity of devices, enamels, crests, buildings, military and naval buttons, a capital lion, and other designs for ornamental buttons. Messrs. Allen and Moore, among many choice and beautiful articles in hardware, exhibited metal buttons of fine finish; and Mr. Ashton, showed velvet buttons, which we marked as very rich in their effect. We have spoken of the manufacture of pearl buttons, and Messrs. Elliott exhibited some with metallic rims — an arrangement which conveyed the desirable idea of exceeding care in the finish. Messrs. Ingram illustrated very fully the horn button in its history and varieties. Messrs. Heeley also had some metal articles amid their beautiful hardware. Mr. Nash, a die sinker, showed the dies by which the metal buttons were stamped. In a case exhibited by Mr. Brissrabb, were specimens of the mother-o'-pearl button, and among them of the black pearl.

The general characteristics of the specimens of button manufacture must, of course be, to a great extent, similar, the contributions having been chiefly sent by first-rate

producers, who, in running an honourable race with their rivals, all attained the point of excellence, which left little room for diversity. In some of the cases there was more artistic taste, as regards the designs of ornament, than in others; but the mechanical finish of the whole array defied censure. The button manufacture of England was obviously and decidedly creditable to the country.

CHAPTER XVII.

SOAP.

ITS COMMERCIAL IMPORTANCE—TEST OF CIVILIZATION—EARLY HISTORY OF—HOMERIC VIRGINS—PLINY, STRABO, GEBER—MODERN HISTORY OF—VARIETY OF SUBSTANCES EMPLOYED—DIFFERENT MODES OF MANUFACTURE—ITS PROPERTIES AND ACTION—NUMBER OF EXHIBITORS—EXTENSIVE USE IN GREAT BRITAIN—EXCISE DUTY.

The magnitude of the manufacture of soap, the importance of the trade, and the enormous capital embarked in it, as well as the wonderful relation which it bears with regard to the most important links in the chain of chemical industry, is not often sufficiently estimated. A distinguished chemist of the present day says:—"The quantity of soap consumed by a nation would be no inaccurate measure whereby to estimate its wealth and civilisation. Political economists, indeed, will not give it this rank; but, whether we regard it as joke or earnest, it is not the less true that, of two countries of an equal amount of population, we may declare with positive certainty, that the wealthiest and most highly civilised is that which consumes the greatest weight of soap. The consumption does not subserve sensual gratification, nor depend upon fashion, but upon the feeling of the beauty, comfort, and welfare

attendant upon cleanliness; and a regard to this feeling is coincident with wealth and civilisation. The rich in the middle ages, who concealed a want of cleanliness in their clothes and persons under a profusion of costly scents and essences, were more luxurious than we are in eating and drinking, in apparel and horses; but how great is the difference between their days and our own, when a want of cleanliness is equivalent to insupportable misery and misfortune!"

It is interesting to cast a glance upon the early history of this important branch of trade. No mention of soap is to be found in the works of authors prior to the Christian era. The term soap occurs repeatedly in the Old Testament, but the learned Beckmann has proved, in his *Treatise on Soap*, that the Hebrew word *borith*, which has been rendered soap, rather means alkali. One of the most ancient descriptions of bathing and washing is to be found in Homer's narrative of the preparations made by the mother of the lovely Nausicaæ, for the washing expedition to the river. Life-sustaining meats and refreshing wines, softening oil in golden vessels for anointing the skin, are carefully enumerated; but soap formed no part of the inventory. The Homeric virgins were ignorant of this invaluable oleo-alkaline compound. Pliny is the first writer who gives us an authentic account of soap. He states that it is made from tallow and ashes, the best materials being goats'-tallow and beech-ash. He was also acquainted with the hard and soft varieties of soap; he calls it a Gallic invention, but states that it was particularly well prepared in Germany, where the men were more in the habit of using it than the women. It served to colour the hair yellow. From the description of Pliny, it is evident that he really means soap, although the purpose for which it was employed creates some difficulty; and it would appear that the soap of the ancients contained some colouring agent, and served chiefly as a hair-dye, and likewise as a remedial agent. It does not seem that it was used for the purposes for which it is now

almost exclusively employed. Besides several kinds of fullers'-earth, and plants with saponaceous juices (*struthium*), the ancients availed themselves of solutions of soda and potash, which continue in use for washing in the present day. Strabo speaks of an alkaline water (soda) in Armenia, which was used by the scourers for washing clothes, and we find express mention of the employment of a lye made with the ashes of plants (potashes), in cleansing oil and wine jars, and the images of the gods in the temples. The method of strengthening the lye by means of quick-lime was known, undoubtedly, in the time of Paulus Ægineta. The agent most commonly used for washing garments, however, was putrid urine, which is still employed in the cloth districts for washing wool. The fullers were literally and metaphorically in bad odour, and were required to exercise their trade outside the town, or in unfrequented streets, but they were permitted to place tubs at the corners of the streets, for the convenience of passengers and their own profit. Regarding urine in the light of soap, the Emperor Vespasian may be said to have originated the soap duty, as this source of revenue was not lost sight of by him, though, as Beckmann remarks, it does not appear very clear how the tax was collected.

After Pliny, soap is mentioned by Geber, in the second century of the Christian era, and at a later period, frequently by the Arab writers: but although undoubtedly used for washing, it is spoken of chiefly as a remedial agent for external application. It would be a difficult matter to trace the onward progress of soap-making, step by step, but it is certain that the boiling of soap flourished in the seventeenth century, as we possess extensive directions of that date for its preparation. It is only in the most modern times, that the soap-manufacture has attained that extraordinary development which distinguishes this branch of trade; various circumstances have contributed to produce it. The valuable researches of Chevreul, although they explain the nature of saponifica-

tion, have contributed less to the advance of the soap-manufacture than to that of candle-making, hereafter to be described. On the other hand, the development of the manufacture of soda has proved a most powerful stimulus to that of soap, which, when freed from its dependence on the uncertain and limited supply of barilla and kelp, made such strides as could not have been anticipated. Mr. James Muspratt, who was the first in England to carry out successfully, and on a large scale, Leblanc's method of preparing soda from chloride of sodium (sea-salt), informs us that he was compelled to give away soda by tons to the soap-boilers, before he succeeded in convincing them of the extraordinary advantages to be derived from the adoption of this material. As soon, however, as he had effected this, and when the soap-boilers discovered how much time and money they saved by using artificial soda, orders came in so rapidly, that Mr. Muspratt, to satisfy the demand, had his soda discharged red-hot into iron carts, and thus conveyed to the soap-manufactories. From that period, a constant race was kept up between soap-making and the artificial production of soda; every improvement in Leblanc's process was followed by an extension of the soap-trade; and it is a curious fact, that the single sea-port of Liverpool, exports annually more soap at present, than did all those of Great Britain, previous to the conversion of chloride of sodium into carbonate of soda. The manufacture of soap has, on the other hand, been a powerful stimulus to the preparation of soda and of the important secondary product, hypochlorite of lime (bleaching powder), which are so intimately allied with almost all branches of chemical trades. Thus soap occupies one of the most important pages in the history of applied chemistry. The increase in the consumption of this article has led, moreover, for the discovery of new materials for its production. It has opened new channels to commerce, and thus it has become the means, as well as the mark of civilisation. Almost simultaneous with the employment of soda, the oils of the cocoa-

nut and the palm have been introduced into the manufacture of soap. The statistics respecting the imports into the United Kingdom and France, demonstrate the increasing consumption of these oils. The development of the trade in palm oil has contributed largely to the abolition of the iniquitous slave-trade on the west coast of Africa, and in many parts of the coast, has entirely suspended it.

Before we proceed to the examination of the separate specimens of the soaps which were exhibited, a few words may be said respecting the materials employed in their manufacture. They are, on the one hand, alkalies, and on the other, fatty and resinous substances derived from the organism of animals and plants, especially tallow, lard, palm oil, cocoa-nut oil, olive oil, linseed oil, fish oil, and common resin. Although physically and chemically widely distinguished from one another, fats and oils present numerous analogies. Neither of these substances is a pure chemical compound; the majority are mixtures in varying proportions of different chemical bodies, which may be isolated by mechanical or chemical processes. When this separation has been effected, the isolated substances, which are the proximate principles of the fatty or oily bodies, though again differing much from one another, exhibit one common chemical character; when exposed to the influence of powerful decomposing agents, they are broken up in a similar manner, yielding on the one hand an acid, and on the other a neutral body. All fats may be resolved into two proximate fatty substances, one of which is fluid at the common temperature—it is termed olein; the other is solid, and is called stearin. The preponderance of one or the other of these proximate constituents determines the state of aggregation of the fat. The body usually designated stearine is generally a mixture of the stearin of the chemist and an analogous body, margarin; the two substances differing in their relative proportion according to the source from which the fat is obtained. Thus, the solid fat from sheep (tallow) contains chiefly stearin; that

of the pig (lard); and of olive oil, chiefly margarin; the solid fat of palm oil is palmitin; that of cocoa-nut oil, cocin. Stearin, margarin, olein, palmitin, and cocin are all compounds of certain fatty acids, with oxide of glyceryl, and may be viewed as substances resembling neutral salts, or rather compound ethers. The changes which all these substances undergo, when submitted to the action of powerful bases, is well illustrated by the deportment of olein with oxide of lead (litharge). When boiled with this base, the olein is decomposed into oleic acid and oxide of glyceryl. The former combines with the base, forming an insoluble soap, called oleate of oxide of lead (diachylon plaster); and the oxide of glyceryl, separating in combination with water, forms glycerin (hydrated oxide of glyceryl), a substance having a certain analogy with the group of bodies termed alcohols. It remains dissolved in the water employed. If olein is boiled with a solution of potash or soda, oleates of potash or soda are obtained; but being soluble in water, they remain dissolved together with the glycerin.

The oleates of potash or soda, when separated from the water by processes immediately to be discussed, are what we call, in common life, soaps. Similar soaps are formed by the remainder of the fatty acids; for example, stearic and margaric acids. Palmitate of soda, obtained by boiling palm oil with soda, likewise forms a chief ingredient of many soaps. Potash and soda, as they occur in commerce, are combinations of the alkaline bases, thus denominated by the chemists with carbonic acid, and though by long boiling they could decompose (saponify) fats, yet the operation is tedious, and the saponification generally incomplete. It is better to deprive the alkalies of their carbonic acid, which is done by mixing them with quick-lime and water; the quick-lime combines with the carbonic acid, forming an insoluble carbonate of lime (chalk), and the water retains the potash or soda in solution, contaminated still with such impurities as the alkalies contained (sulphates and chlorides for example), and a minute

quantity of caustic-lime. Common resin (colopony) is the residue of the distillation of natural turpentines, and consists principally of pinic acid, together with a little sylvic and colophonic acids. When resin is boiled with alkalies, carbonated or not, a compound is readily obtained, but of course no glycerin. Thus, when it is boiled with soda, a pinate of soda is chiefly produced. This compound exists in considerable quantity in yellow soap, and gives to it its distinctive character. The character of soap is not only affected by the nature of the acids which it contains, but also by that of the alkali which has served for its preparation; the soaps containing potash are generally soft and pasty; those prepared with soda are hard and solid.

The compounds of stearic, margaric, oleic, palmitic, cocinic, pinic, and sylvic acids, with potash and soda, are all readily soluble in alcohol and hot water, but more so in the former, which, on evaporation, leaves the soap in a translucent state; hence its application in the preparation of "transparent soaps." Soaps, however, are insoluble in a solution of many neutral salts, particularly when concentrated; this property is of great use to the soap-boiler, who employs it for the separation of the soap from its solution in water, generally adding common salt to set the soap at liberty. As soaps are likewise insoluble in strong alkaline lyes, the same end is sometimes attained by boiling down the soap to a certain consistence, when it separates from the excess of lye. The soap made with cocoa-nut oil is, however, soluble in a very strong brine, and the same plan of separation does not succeed with it; but, as it is more generally employed together with other fats, this difficulty is then overcome. Its property of dissolving in salt water renders it peculiarly adapted to the formation of a marine soap. One remarkable property of cocoa-nut oil soap is, that of solidifying with a much larger quantity of water than most other soaps, thus giving a larger yield, but, of course, being of proportionally less value. This property is, however, unfortunately, often turned to profitable account by the soap-maker. As an

instance, may be quoted an analysis of Dr. Ure, who found a London cocoa-nut oil soap to contain seventy-five per cent. of water, whereas twenty-five per cent. of water is a large quantity for any but potash soaps to contain, and these generally contain less than fifty per cent. The greater part of our knowledge concerning the chemical constitution of fats, and the changes which accompany their decomposition under the influence of alkalies, is due to the masterly researches of Chevreul, prosecuted with wonderful acuteness and perseverance, from 1813 to 1823, when they were published in Paris in a collected form, under the title of *Recherches Chimiques sur les Corps Gras d'Origine Animale*, a work which will ever remain a model of philosophical inquiry.

There are two processes chiefly employed in the preparation of soaps, the most simple of which is that called the *cold process*, or the *small-boiler process*. For the purpose of making soap in this manner, the alkaline lye is prepared from the purest commercial soda, and concentrated by evaporation. As the chloride of sodium and sulphate of soda, which commercial soda contains, are nearly insoluble in a strong alkaline solution, they crystallize out, especially on allowing the lye to stand for some days, thus leaving it much purer. A weighed quantity of fat is melted, and the strength of the lye having been previously ascertained by taking its specific gravity, a certain portion is weighed or measured, and separately heated, and then stirred with the melted fat. Saponification soon occurs, and on cooling, the soap solidifies. It is very evident that soap made in this manner must contain the glycerin; moreover, as it is very difficult to obtain an exact neutralization of the fat or alkali, one or the other is often in excess, generally the fat; this prevents such soap from giving so good a lather as those prepared by the more usual method.

The ordinary method is called the *large-boiler process*, and it is usually conducted on a very large scale, in boilers capable of holding many tons. A quantity of

weak soda-lye is put into the iron or copper boiler, and raised to the boiling point; and the whole of the fat is generally added at one time. The ebullition is then carried on for some time, and when the lye has become exhausted of its alkali, it is pumped away, and a fresh portion of lye is added. After repeated boilings and pumpings, the saponification is completed, and the soap is brought to strength by boiling down.

Now the soap-boiler may wish to prepare either white or mottled soap. If a white or curd soap is required, the soap is "fitted," that is, boiled with a certain quantity of water or weak lye, and allowed to settle, when the black impurities ("nigre") fall to the bottom, and the soap is then removed to the frames, and allowed to cool. These frames are composed of a number of separate planks, to facilitate the removal of the soap. The mottled soap is prepared in a similar manner, except that the operation of fitting is dispensed with, the "nigre" is left in the soap. This "nigre" consists chiefly of sulphide of iron, produced by the action of the lye, which always contains a minute quantity of sulphate of sodium, on the vessel. In Marseilles and other countries where olive-oil-soap is made, a quantity of sulphate of iron (green copperas) is added; and in this case the mottling is produced jointly by the sulphide of iron (the black portion) and a true iron soap (the red portion). In order that the metallic compound may not fall to the bottom (as in *fitting*), the soap has to be much more concentrated; when removed from the boiler it is of one uniform slate tint, but as it cools, the metallic compounds separate into nodules, and by the trickling of the excess of lye through the mass, they take up certain forms, which produce the appearance called mottling. Hence mottled soap is of more value, from its containing a less proportion of water. It is evident, in comparing this with the cold process, that it is much more scientific; as an excess of alkali may be employed to ensure complete saponification, with the perfect certainty that it can be got rid of in the lyes: the glycerin is also

removed, with the impurities contained in the fat, at each pumping; and a very pure chemical compound is obtained, notwithstanding the employment of comparatively impure materials. If the soda-ash employed does not contain sufficient saline impurities to throw up the soap, it is necessary to add a solution of common salt to effect this object each time the exhausted lye is pumped off.

The detergent property of soap is usually considered to be dependent entirely on the quantity of alkali which it contains, and hence the question arises, why pure alkali should not be employed in preference. An objection to this is the caustic character of the alkali, which is injurious, not only to the hands of the person using it, but also destructive of the articles washed, and especially of some colours of dyed goods. By combining with fatty acids, the alkalies are rendered essentially milder in their action, without being deprived of their capability of entering into combination with various impurities, and more particularly with certain fatty bodies. The most common explanation of the washing power of soap is founded upon Chevreul's observation, that soaps are decomposed by large quantities of water, giving rise on the one hand to acid soaps, and, on the other, liberating a quantity of free alkali which remains in solution. According to this view, soap is a sort of magazine of alkali, which it gives up in the exact quantity required at any moment when it is rubbed with water. The combination of the alkali with some part of the dirt cannot be denied. Several constituents of this very indefinite admixture of many substances are of an essentially acid character, especially those derived from perspiration: others become acid when exposed on a large surface to the action of the air, in consequence of a sort of spontaneous saponification. This action cannot, however, be the sole *modus operandi* of soap, the valuable properties of which, without doubt, arise, in a great measure, from its power of dissolving substances which are insoluble in water. We know that certain mineral salts exert a

solvent power upon substances which are entirely insoluble in water: thus it is well known that borax causes shell-lac to dissolve with great facility, and the chemist will at once call to mind the remarkable solvent property possessed by a soapy compound ready formed in the animal organism—bile is essentially a combination of an alkali with fatty acids (glycocholic and taurocholic), and it dissolves with great facility the neutral body, cholesterin, which, like fats, is soluble in water. In addition to these two modes of operation, soap doubtless also produces a mechanical effect. The property which it has of increasing the cohesion of water, so as to enable it to form a lather or froth, is most valuable in the removal of solid insoluble particles of dirt, which are carried away by the frictional action of the suds when forced into and out of the minute interstices of the substances subjected to the operation of washing, and are kept suspended by the froth, and thus prevented from again soiling them.

There were in the great Exhibition sixty-two exhibitors of soap. Many of these received prize medals, and not a few obtained honourable mention. In no country in the world is the manufacture of soap carried on to so large an extent as in the United Kingdom, in which there are 329 makers. Ireland not being subject to a duty on soap, there are no ready means of ascertaining the quantity which is there manufactured; but in Great Britain alone the production amounted, in the year 1850, to 204,410,826 lbs., and yielded an excise duty of £1,299,232 10*s.* 2*d.* Of this quantity 12,555,493 lbs. were exported to foreign parts, the drawback on it being £82,308 18*s.* 9*d.* The total quantity consumed in Great Britain, therefore, amounted to 191,855,333 lbs. Of this quantity 22,858,382 lbs. were used by manufacturers, on which the duty, amounting to £97,342 0*s.* 11*d.* was remitted. This leaves the net revenue derived from the soap-duty at £1,119,581 10*s.* 6*d.*, after deducting the drawback and the remission to manufacturers. Deducting the quantity exported, and that used by manufacturers, it appears that

168,996,951 lbs., or, in round numbers, 75,445 tons, were consumed in 1850 for domestic use in Great Britain (making 8 lbs. 1 oz. each person); besides that manufactured in Ireland, of which there are no returns. Of the different varieties of toilet and scented soaps, and of their general claims to prize medals and honourable mention, we have already spoken in a former chapter, when treating on the subject of "perfumery."

CHAPTER XVIII.

WORKING MEN.

JAMES WATT—HIS EARLY LIFE—VARIOUS CLAIMS TO THE DISCOVERY OF THE POWER OF STEAM—FIRST REAL STEAM-ENGINE INVENTED BY WATT—ITS GREAT SUPERIORITY OVER FORMER INVENTIONS—VERSATILITY OF HIS GENIUS—HIS NUMEROUS IMPORTANT DISCOVERIES—STATUE IN WESTMINSTER ABBEY—JACOB PERKINS—HIS WONDERFUL INGENUITY—STEREOTYPE CHECK-PLATE—THE PERPETUAL MOTION—BATHOMETER—STEAM-GUN—JOSIAH WEDGWOOD—ELEGANT POTTERY—BARBERINI VASE, ETC., ETC.

As our object in describing the contents of the vast Emporium of Industry and Art, which forms the subject of our lucubrations, has, from the outset, been to give our readers as much variety as possible, we will now pause awhile in our dissertation on things produced, and indulge in a brief consideration of the original producers—those master minds which from time to time have appeared among us, and have diffused far and wide their light and their intelligence to the improvement of science and the benefit of mankind. We shall, therefore, in our present chapter, give a few brief sketches of the lives of "working

men," who, by their well-directed industry and ingenuity, have distinguished themselves above their fellows, and contributed new or improved principles of importance to the manufacturing resources of the world. We trust these notices will be interesting, as illustrative of the progress of art culture, and will also serve as an encouraging excitement to thousands of "working-men" of our own day, any one of whom may possibly have it in his power to add his mite to the general store of valuable experiences, and to receive his reward in fame and fortune for himself and his descendants.

JAMES WATT.—The celebrity of some men may be compared to a meteor which appears for a short time and then vanishes away; their memory is only found in their marble monuments. Others, again, like planets, have succeeded in attaining a more permanent distinction; they have conferred benefits upon their fellow men which remain after them; they require no busts—no empty gorgeous structures to tell that they have lived; their memory is in their works. Of the latter class was James Watt, the immortal discoverer of the steam-engine. He was born in 1736, at Greenock, in Scotland, where his father was a merchant and magistrate. His grandfather and uncle both distinguished themselves as mathematicians and engineers. The subject of our memoir was educated in his native town, which has long been distinguished as a port of extensive commercial relations and for the elegance and substantiality of the works of its mechanics, especially in reference to navigation. Till the age of sixteen he continued at the grammar-school. At the age of eighteen he was sent to London, being bound to a distinguished mathematical instrument maker. Here, however, the delicacy of his health, from an attack of rheumatism, occasioned by working one winter's day in the open air, prevented him from deriving any advantage from his situation, and he was soon obliged to return to his native country. In 1757 he went to reside in the University of Glasgow, being appointed philosophical instrument maker

to that seminary, with apartments in the building. In this situation he remained till 1764, when he married his cousin, Miss Miller. He then established himself in the town as an engineer. While in this capacity, he was consulted with regard to the great canal which traverses Scotland from east to west, termed the Caledonian Canal; and he is said to have projected the canal which unites the Clyde and the Forth. An accidental circumstance, however, had given a different bent to his pursuits. One of Newcomen's steam-engines had been sent to him from the Natural Philosophy class for the purpose of being repaired, and this turned his attention to the power of steam, of which he was destined to make such splendid applications.

It has been usually admitted that the first individual who ascertained the fact that steam was capable of raising weights or water, was the marquis of Worcester. M. Arago, however, in the *Annuaire* for 1837, denies the accuracy of this conclusion, and claims the discovery for Salomon de Caus, a countryman of his own. A few extracts in the words of the respective authors will enable the reader to draw his own inferences. Hiero, of Alexandria, 120 years before the Christian era, was acquainted with the fact that steam, under certain circumstances, could give rise to motion. In 1543, Blasco de Garay, a sea captain, proposed to the emperor Charles V., to make embarkations even when there was a perfect calm, and without sails and oars. In June of the same year he is said to have made an experiment with a vessel of 200 tons, which he carried into Barcelona, according to some at the rate of a league per hour; according to others at the rate of two leagues in three hours. The apparatus which he employed was a large cauldron of water attached to wheels connected with the sides of the vessel. This account is given by M. Gonzalez, in Zach's astronomical correspondence for 1826. It is altogether, however, so improbable that little importance can be attached to it; such is the Spanish claim to the discovery of the force of vapour. In 1615, Salomon de

Caus wrote a work entitled *Les Raisons des Forces Mouvantes, &c.* In this he states that if water be introduced into a copper globe, with a tube passing vertically through the upper part of the globe, and dipping under the surface of the water, on the application of heat to the globe the water will be driven up the tube; he observes—"the force of the vapour (produced by the action of fire) which causes the water to rise is produced from the said water, which vapour will depart after the water shall have passed out with great force." This is the French claim to the invention of the steam-engine. In 1629, Branca, of Rome, described the eolipyle, or vapour blow-pipe. This, however, has little connection with the subject. In 1663, the marquis of Worcester published his *Century of Inventions.* In his sixty-eighth invention, he states that he has discovered an admirable and very powerful method of raising water by the assistance of fire, not by aspiration, for as the philosophers say, *intra sphœrum activitatis*, the aspiration acting only at certain distances; "but my method has no limits if the vessel possesses sufficient strength." He took a cannon, filled it to three-fourths, and shut up the open end; he then kept up a constant fire around it, and in the course of twenty-four hours the cannon burst with a great noise. "Having a way to make my vessels so that they are strengthened by the force within them, and that they are filled in succession, I have seen water run in a continuous manner, as from a fountain, to the height of forty feet. A vessel full of water rarefied by the action of fire, raised forty vessels of cold water. The person who superintends this experiment has only two stop-cocks to open, so that at the instant when one of the two vessels is emptied, it is filled with cold water during the time that the other begins to act, and this in succession. The fire is kept in a constant degree of activity by the same person, he has sufficient time for this during the intervals which remain after turning the stop-cocks." Such is the English claim to the discovery of the steam-engine. Whatever opinion may be arrived at, one thing is certain, that if his

predecessors were ignorant of the force of vapour and its moving power, the marquis of Worcester was quite familiar with them. In 1683, sir Samuel Moreland wrote his *Elevations of Water by all kinds of Machines, &c.*, a manuscript preserved in the British Museum. He observes, that "water being evaporated by the force of fire, its vapours require a much greater space (about 2,000 times) than the water previously occupied, and rather than be confined will burst a piece of cannon. But being well regulated according to the rules of statics, and by science reduced to measure, to weight, and to balance, then they will carry their burdens peaceably (like good horses); and thus they will be of great use to the human race, particularly for raising water." In 1690, Denis Papin, a native of Blois, in France, first thought of placing a piston in a cylinder, and acting upon it by the force of steam. It is unnecessary to enter into the question of the priority of the discovery of the steam-engine from the preceding details, because they appear merely to demonstrate the force of steam, or its moving power—the alphabet of the steam-engine.

In 1698, captain Savery obtained a patent for an instrument in which the power of steam was applied to practical purposes. The water was placed in a boiler, the steam escaped by a tube at the upper part of the boiler into a large spherical vessel, where, upon being condensed, a vacuum was formed, which enabled the atmosphere to act. It was, therefore, the atmosphere, and not the steam which was the moving power. In 1705, a patent was taken out for an improved engine on the same principle, in the names of Newcomen, Crawley, and Savery. It was in 1764, that James Watt was employed to repair a model of one of these engines belonging to the Natural Philosophy class in Glasgow college. He was struck with the defects of the machine, and set about improving it. In 1768, he completed his first engine, which, as with those now in use, differed from that of Newcomen by the condensation of the steam taking place in a second vessel, so that the

descent of the piston was produced by the force of the steam, and not by atmospheric pressure; the ascent of the piston was also produced by the power of the steam. The engine of Watt was therefore a true steam-engine; those which preceded it can only be considered as machines which produced certain effects by the atmosphere acting on a vacuum produced by the condensation of steam.

Dr. Roebuck supplied Watt with the means of accomplishing this great work, and in 1769 he obtained his first patent. Watt had remarked that two-thirds of the steam were condensed by the contact with cold water; hence there was a loss of two-thirds of the fuel. He first attempted to substitute a wooden pipe for a tube of iron, considering that the wood is a worse conductor of heat; but he found that the wood had less resistance to the sudden alternations of temperature. He then thought of passing the steam into an iron tube without cooling the walls of the tube; this constituted the invention of the condenser. This vessel, free from air, and communicating with the water, being opened at the moment when the tube is filled with steam, draws the latter towards it, and when the vessel receives at the same time a jet of cold water, the steam which is passing to fill it is condensed; the remaining part of the steam in the pipe is removed into the vacuum caused by condensation, and thus the piston is allowed free play. To get rid of the water in the condenser, a small air-pump was applied, which was worked by the piston. The invention of the condenser was then Watt's first great improvement. The second was the admission of steam above and below the piston according as it was to be depressed or raised. He surrounded the metal tubes with wood in order to keep in the heat. He calculated with precision the quantity of fuel necessary for producing a certain portion of steam and the volume of cold water required to condense it. Such were the inventions for which the new patent was obtained, but funds were wanted to extend the utility of the discovery. Fortunately, in 1776, Dr. Roebuck, who had exhausted

his means, met with a purchaser of his interests in the patent in the person of Matthew Bolton, of Birmingham. To him, therefore, it may with justice be said that the country owes the present diffusion and importance of the steam-engine. The firm of Watt and Bolton commenced their manufactory at Birmingham by constructing a steam-engine, which all those interested in mining were requested to inspect. The invention began gradually to be appreciated, especially in Cornwall, and Watt's engine very soon replaced that of Newcomen. One great encouragement to adopt the new engine was the terms upon which it was supplied. The agreement was, that one-third of the saving of fuel over the old engine should be the price of the new engine. The saving was carefully ascertained in this way: the quantity of fuel necessary for producing a certain number of strokes of the piston was ascertained by Newcomen's engine and by a new one of the same dimensions. The number of strokes were determined by means of a piece of clock-work, termed the *counter*, attached to the engine, and so arranged that every stroke advanced the hand one division. The instrument was placed in a box supplied with two keys, and was opened at the time for settling accounts in presence of the agent of Watt and Bolton, and of the director of the mine. To show the amount of saving it is only necessary to state that the sum which the firm derived from three engines in one year at the Chace-water mine, in Cornwall, amounted to £2,382, proving that the saving of fuel by the new plan was equal to upwards of £7,000 per annum, being equivalent to £2,382 per annum on each engine.

The manufactory of Soho speedily extended its limits, and what was once a sterile hill soon became a populous and fertile manufactory. The firm obtained an extension of their patent to 1800. To this period the engine had only been employed to raise water; but, in 1800, Watt began to think of applying it to mills. This, he conceived, might be effected on the principle of the spinning-wheel, where the impulse which turns it one-half, completes the

revolution. While engaged with his models, he learned that a manufacturer of Birmingham, named Richards, had constructed what he was in search of. He procured a plan of it, and found that it was precisely his own; he ascertained that his own plan had been sold by one of his faithless workmen to Richards, who had procured a patent. It was too late to claim the invention, and he therefore sought for a new plan. He accordingly invented what is termed the sun and planet motion.

The intelligent and aspiring mind of Watt, however, was not content with directing its attention to one subject alone. He invented, in 1779, a copying-press, consisting of two cylinders, between which a sheet of moistened paper was passed and applied over a printed sheet; this contrivance was very successful. In March, 1787, he introduced into Great Britain the method of bleaching cotton by means of chlorine, which had been discovered in France by Berthollet.

This claim was at one time disputed in favour of Professor Copland, of Aberdeen; but it was quickly set at rest on the side of Mr. Watt. In 1800 he retired from the firm with a handsome fortune, and was succeeded by his son, who continued along with the son of Mr. Bolton to carry on the manufactory. During his residence in Glasgow his first wife died. At Birmingham he married the daughter of Mr. Macgregor, a manufacturer in Scotland; with whom, in the heart of his family, he happily spent the evening of his days. He was elected a fellow of the Royal Societies of London and Edinburgh, and the Institute of Paris, in 1808, made him one of their eight foreign associates. In 1817 he visited Scotland for the last time. In the course of two years afterwards his health broke down, and he died on the 25th of August, 1819, aged eighty-four years, beloved and respected by all. Mr. Watt was one of the most extraordinary men of any age. He was not only a mechanic, he was an accomplished scholar, and yet in a great measure self-taught. He was familiar with the modern languages,

and had an excellent acquaintance with chemistry, physics, antiquities, architecture, and music; in short, he was generally well-informed. Possessing all those requisites, and a splendid benefactor of his country, it is remarkable that government never conferred any honour upon him. Immersed in expensive wars, which deluged foreign lands with the blood of our fellow-creatures, and impoverished our own people, it sought only to bestow rewards on those who were foremost in the fight. It was perhaps well; the days of these men are past, but those of Watt will endure for ever. The visitor to the ancient relics of Westminster Abbey may have noticed many a gorgeous monument in memory of individuals who have left no record behind them, save these heartless stones, or a notice, perhaps, in the history of battles of their having assisted in the premature death of some friend of freedom, or unfortunate foe; he looks long in vain for the monuments of those who have succeded in advancing the powers of the mind, and at last espies an obscure tablet which tells that only a mere spot can be spared for the truly mighty dead. The memory of Watt was left to be established in peaceful times, when a philosopher, the hero of intellect, is valued above a hundred warriors, the heroes of the passions; for Watt assisted in superseding the barbarism of war. A handsome statue of Watt was erected, in 1824, at Birmingham. Glasgow has a similar tribute to his memory, and Westminster Abbey can now boast of having deposited within its walls a marble statue of one who has conferred greater benefits on his country and on the world than perhaps any individual commemorated by its monuments.

Our next "worthy" we select from our transatlantic brethren. Jacob Perkins was descended from one of the oldest families of that ancient portion of the state of Massachusetts, the county of Essex—a region of stubborn soil, but rich in its production of *men*. Matthew Perkins, his father, was a native of Ipswich, and his ancestor was one of the first settlers of that town. Matthew Perkins

removed to Newburyport in early life, and here Jacob Perkins was born, July 9th, 1766. He received such education as the common schools of that day furnished, and nothing more. What they were in 1770 may be guessed. At the age of twelve he was put apprentice to a goldsmith of Newburyport, of the name of Davis. His master died three years afterwards; and Perkins, at fifteen, was left with the management of the business. This was the age of gold beads, which our grandmothers still hold in fond remembrance—and who wonders? The young goldsmith gained great reputation for the skill and honesty with which he transformed the old Portuguese *joes*, then in circulation, into those showy ornaments for the female bosom. Shoe-buckles were another article in great vogue; and Perkins, whose inventive powers had begun to expand during his apprenticeship, turned his attention to the manufacturing of them. He discovered a new method of plating, by which he could undersell the imported buckles. This was a profitable branch of business, till the revolutions of fashion drove shoe-buckles out of the market. Nothing could be done with strings, and Perkins put his head-work upon other matters. Machinery of all sorts was then in a very rude state, and a clever artizan was scarcely to be found. It was regarded as a great achievement to effect a rude copy of some imported machine. Under the old confederation, the state of Massachusetts established a mint for striking copper coin; but it was not so easy to find a mechanic equal to the task of making a dye. Perkins was but twenty-one years of age when he was employed by the government for this purpose; and the old Massachusetts cents, stamped with the Indian and the Eagle, now to be seen only in collections of curiosities, are the work of his skill. He next displayed his ingenuity in nail machinery, and at the age of twenty-four, invented a machine which cut and headed nails at one operation. This was first put in operation at Newburyport, and afterwards at Amesbury, on the Merrimac, where the manufacture of nails has

been carried on for more than half a century. Perkins would have realised a great fortune from this invention, had his knowledge of the world and the tricks of trade been in any way equal to his mechanical skill. Others, however, made a great gain from his loss; and he turned his attention to various other branches of mechanical arts, in several of which he made essential improvements, as fire-engines, hydraulic machines, &c. One of the most important of his inventions was in the engraving of bank bills. Forty years ago, counterfeiting was carried on with an audacity and a success which would seem incredible at the present time. The ease with which the clumsy engravings of the bank bills of the day were imitated, was a temptation to every knave who could scratch copper; and counterfeits flooded the country, to the serious detriment of trade. Perkins invented the stereotype check-plate, which no art of counterfeiting could match; and a security was thus given to bank paper which it had never before known. There was hardly any mechanical science in which Perkins did not exercise his inquiring and inventive spirit. The town of Newburyport enjoyed the benefit of his skill in every way in which he could contribute to the public welfare or amusement. During the war of 1812, his ingenuity was employed in constructing machinery for boring out old honeycombed cannon, and in perfecting the science of gunnery. He was a skilful pyrotechnist, and the Newburyport fireworks of that day were thought to be unrivalled in the United States. The boys, we remember, looked up to him as a second Faust or Cornelius Agrippa; and the writer of this article has not forgotten the delight and amazement with which he learned from Jacob Perkins the mystery of compounding serpents and rockets. About this time, a person named Redheffer, made pretensions to a discovery of the perpetual motion. He was traversing the United States with a machine exhibiting his discovery. Certain weights moved the wheels, and when they had run down, certain other weights restored the first. The experiment seemed per-

fect, for the machine continued to move without cessation; and Redheffer was trumpeted to the world as the man who had solved the great problem. Perkins gave the machine an examination, and his knowledge of the powers of mechanism enabled him to perceive at once that the visible appliances were inadequate to the results. He saw that a hidden power existed somewhere, and his skilful calculations detected the corner of the machine from which it proceeded. "Pass a saw through that post," said he, and your perpetual motion will stop." The impostor refused to put his machine to such a test; and for a sufficient reason. It was afterwards discovered that a cord passed through this post into the cellar, where an individual was stationed to restore the weights at every revolution. The studies, labours, and ingenuity of Perkins were employed on so great a variety of subjects, that the task of specifying and describing them must be left to one more fully acquainted with the history of the mechanical arts in the United States. He discovered a method of softening and hardening steel at pleasure, by which the process of engraving on that metal was facilitated in a most essential degree. He instituted a series of experiments, by which he demonstrated the compressibility of water, a problem which for centuries had baffled the ingenuity of natural philosophers. In connexion with this discovery, Perkins also invented the bathometer, an instrument for measuring the depth of the sea by the pressure of the water; and the pleometer, to measure a ship's rate of sailing. Perkins continued to reside in his birth-place till 1816, when he removed from Newburyport to Boston, and subsequently to Philadelphia. His attention was occupied by steam machinery, which was beginning to acquire importance in the United States. His researches led to the invention of a new method of generating steam, by suddenly letting a small quantity of water into a heated vessel. After a short residence in Philadelphia, he removed to London, where his experiments with high-pressure steam and other exhibitions which he gave of his inventive powers, at once

brought him into general notice. His uncommon mechanical genius was highly appreciated; and his steam-gun was for some time the wonder of the British metropolis. This gun he invented in the United States, and took out a patent for it in 1810. It attracted the notice of the British government in 1823, and Perkins made experiments with it before the Duke of Wellington and a numerous party of officers. At a distance of thirty-five yards he shattered iron targets to pieces, and sent his balls through eleven planks, one inch thick each, and placed an inch apart from one another. This gun was a very ingenious piece of workmanship, and could discharge about one thousand balls per minute. Perkins continued in London during the remainder of his life. He never became rich. He lacked one quality to secure success in the world—financial thrift. Everybody but himself profited by his inventions. He was, in fact, too much in love with the excitement of the chase, to look very strongly at the pecuniary value of the game.

We shall close our present chapter with a short notice of Josiah Wedgwood, whose name fully deserves to be recorded in the list of English worthies. To many artists this may be a name but little known; it therefore becomes the more necessary, in a work of this description, to state a few facts connected with the life of this extraordinary man. He was born on the 12th of July, 1730, at Burslem, in Staffordshire, where his father carried on business as a potter. The limited opportunities afforded him for acquiring education may be judged of by the statement of his biographer; that at eleven years of age he worked in his elder brother's pottery as a "thrower." This occupation he was compelled to relinquish in consequence of an incurable lameness in his right leg, caused by the small pox. After a time he entered into partnership with a person name Harrison, at Stoke; and during this period his talent for the production of ornamental pottery first displayed itself. A dissolution of partnership ensued, and, in connection with a person named Wheildon, he

manufactured knife-handles in imitation of agate and tortoise-shell, also imitative leaves, and similar articles. Wedgwood returned to Burslem, and commenced the manufacture of a cream-coloured ware called "Queen's" ware. He was, by Queen Charlotte, appointed her potter. His business greatly improving, he, in conjunction with Mr. Bentley, a man of taste and scientific attainments, obtained the loan of specimens of sculpture, vases, cameos, intaglios, medallions, and seals, suitable for imitation by the processes Wedgwood had discovered. His ingenious workmen, trained in his manufactory, produced the most accurate and beautiful copies of vases from Herculaneum, lent by Sir William Hamilton.

About this time, 1763, the celebrated Barberini vase (in the British Museum, sometime since broken by a lunatic, but now admirably restored), was offered for sale, and Wedgwood bid against the Duchess of Portland; but on her promising to lend it to him to copy, he withdrew from bidding, and the duchess became the purchaser, at the price of eighteen hundred guineas. Wedgwood sold fifty copies of it at fifty guineas each; but the cost of producing them exceeded the amount of the sum thus obtained. After numerous experiments upon various kinds of clay and colouring substances, he succeeded in producing the most delicate cameos, medallions, and miniature pieces of sculpture in a substance so hard as to resist all ordinary causes of destruction or injury. Another important discovery made by him was that of painting on vases and other similar articles, without the glossy appearance of ordinary painting on porcelain or earthenware—an art practised by the ancient Etruscans, but lost since the time of Pliny. Amongst other artists employed by Wedgwood was Flaxman, who assisted him in producing those beautiful sculpturesque ornaments which he was the first in modern times to execute in pottery. In 1771 he removed to a village which he erected near Newcastle-under-Lyne, and characteristically called Etruria. Here his works became a point of attraction to all civilised

Europe. Not only did he encourage artists; but he created a great trade in pottery, and by his taste and talent improved the national taste. Wedgwood's success led to the establishment of improved potteries in various parts of the continent of Europe, as well as in several places in Great Britain and Ireland. His exertions were not merely confined to his own manufactory, but were cheerfully given to the establishing of several useful measures. On the 17th of July, 1766, he cut the first clod for the formation of the Trent and Mersey Canal, which, by the skill of Brindley, completed a navigable communication between the potteries of Staffordshire and the shores of Devonshire, Dorsetshire, and Kent. Wedgwood was a Fellow of the Royal Society, and of the Soctiey of Antiquaries, and had bestowed considerable attention on the science of the action of light, with a view to fixing the images produced by the camera; but neither he nor Sir Humphrey Davy, who also investigated the subject, were fortunate enough to discover any method of retaining these images—a wonderful step in chemistry applied to the arts, which was reserved for Niepce, nearly half a century later. After a successful and honourable career, by which Wedgwood amassed an ample fortune, he died, at the age of sixty-five, on the 3rd of January, 1795. A very fine portrait of this son of genius was painted by Sir Joshua Reynolds, which still exhibits all its original freshness and truth of colour. Indeed, it has been observed that Sir Joshua never tried any of his dangerous experiments in art, when he had a sitter whose fame he deemed worthy to descend to posterity; and such a compliment he deservedly paid to the subject of this memoir.

CHAPTER XIX.

TAXIDERMY, AND ETHNOGRAPHICAL MODELS.

EGYPTIAN EMBALMERS—GREEKS AND ROMANS—THE CALEDONIAN BOAR—ANCIENT TEMPLES—ITALIAN MUSEUMS—ASHMOLEAN MUSEUM—BRITISH MUSEUM—ANCIENT AND MODERN TAXIDERMY COMPARED—ELK FROM TURIN—THE DODO—BARTLETT—HANCOCK—THE HOODED HAWK—THE COMBAT WITH THE QUARRY—THE TROPICAL GROUP—GORDON—LEADBEATER—WILLIAMS AND GARDINER—WURTEMBURG COLLECTION—HERMANN PLOUCQUET—REYNARD THE FOX—ETHNOGRAPHICAL MODELS—MEXICAN AND AMERICAN INDIANS—THE JAMMA BUNDI—MODELS OF KISHNAGHUR—HINDOOS—VARIOUS TRADES—THUGS—COURTS OF JUSTICE IN INDIA—SILK FACTORY, ETC.—MALTESE COSTUMES—SPANISH BULL FIGHTS, ETC.

The art of stuffing animals is generally supposed to be an invention of modern date, and to have originated about the period when the various museums of natural history were founded in Europe. But traces of the art are to be discovered in the earliest records of antiquity, although the methods then employed differ much from those now practised. The procedure of the ancient Egyptians in embalming human remains and dead animals, in some measure resembles the manipulations of the taxidermist; inasmuch as in both, the parts peculiarly subject to decomposition are removed and replaced by more durable materials. But whilst the Egyptian embalmer desired rather to preserve the substance of the body than its form, the taxidermist sacrifices all, except the skin, to the obtaining of a natural representation of the aspect of the living animal. The ancient Greeks and Romans, however, endeavoured to preserve the form, as well as the substance, of the body; but their methods fulfilled the object very imperfectly. The ordinary proceeding consisted in immersion in melted wax

or in honey; this necessarily disguised the shape, even though it remained unimpaired. Perhaps the best of the ancient methods for the preservation of animal substances consisted in placing them in a solution of common salt; which is still done, though for very different purposes. In this manner the sow, which, by bringing forth a litter of thirty pigs, afforded a happy omen to Æneas, was preserved by the priests; and it remained in such excellent preservation, that it was said to have been in existence at Lavinium in the time of Varro. In the same way were preserved two hippocentaurs (probably monstrous births), and also an ape, which, having been sent by the Indians to the Emperor Constantius, happened to die on the road.

It appears to have been the business of the priests to preserve rare animals, or rare natural specimens generally; and this was so prevalent, that we are almost tempted to refer the origin of museums of natural history to the temples of antiquity. Indeed Beckmann, in his *History of Inventions*, quotes a number of instances which support this view. And although it cannot be positively* asserted, from the notices in the Greek and Latin authors, on the subject under review, that methods resembling those used by the animal-stuffer were employed by the ancients; still the circumstance that animals were frequently suspended in the temples, shows that they were not invariably preserved in salt or honey. The ancients must consequently have possessed methods of preserving animal sub-

* In one of the epistles of Horace (Epist. lib. i., Epist. 2, i., 65), addressed to Lollius, a passage is met with, which has been generally construed into a knowledge of taxidermy among the ancients. The words are—

"Venaticus, ex quo
Tempore cervinam pellem latravit in aula
Militat in silvis catulus."

Many interpret *pellis cervina* as a stuffed stag, placed in the hall, and barked at by the dog. This explanation assumes that the ancients decorated their halls in such manner; like a modern hunting-box. The passage is however, intelligible if we translate *pellis cervina* as the mere skin of the stag

stances in the dry state; but they appear to have been ill-adapted to the purpose, for the head of the celebrated Caledonian boar, which Pausanius saw in one of the temples of Greece, had evidently suffered by time or the ravages of insects, and had lost the greater part of its bristles.

The art of preserving animals appears to have been but little, if at all, practised during the middle ages; for we rarely meet with a notice of natural objects being kept as curiosities in the treasuries of emperors, kings, and princes. It is only in the records of the period when the study of natural science was resuscitated, that passages are to be met with indicative of a knowledge of taxidermy, though sportsmen had undoubtedly practised it much earlier, in a rough manner,* for the purpose of making effigies of call-birds, in the absence of the living bird, while they imitated the note of the bird with their own voice, or some artificial contrivance.

The first records of collections of objects of natural history relate to the second half of the sixteenth century; and it appears from them that such museums existed chiefly in Italy, in relation to which the name of Francesco Calceolari deserves especial mention (Verona, 1584). These collections, which were commenced by private individuals, from purely scientific motives, increased in number and importance in the seventeenth century. This period gave birth to the collection of the Tradescants (father and son), which

* Although the foregoing sketch suffices to show that the art of taxidermy can only have been very gradually developed, still it will not be inappropriate to introduce in this place the often-told, but improbable, anecdote of a rich gentleman of London, named Lever, who is said to have possessed a valuable collection of living birds. These all died in one night, owing to the stove used in the aviary having cracked, and the vapours suffocating them. The intensity of Mr. Lever's grief at the loss of his favourites, induced him to make an effort at preserving their dead bodies, and he is said to have succeeded in this by the aid of a physician, who invented animal stuffing for the occasion. These birds are reported to have given rise to the Leverian Museum, specimens from which may yet be met with in the British Museum.

was purchased in 1659, by Elias Ashmole, who presented it, in 1683, to the university of Oxford, and thus founded the Ashmolean museum; and also to the collection of James Petiver, which was much enriched by Sir Hans Sloane, and, on the death of this distinguished naturalist, became the nucleus of the British Museum. It is from this epoch, in which the majority of continental collections took their origin, that the art of preserving skins must be dated; and, from the moment it became subservient to science, it kept pace with the growth and requirements of these institutions.

It was a point of extreme interest, to compare the admirable productions in taxidermy contributed to the Great Exhibition with the old specimens of the art of animal stuffing to be met with here and there in the museums of natural history. Nothing more dissimilar can be imagined; for while the successful productions of modern times present nature to our eyes, and show that the artist has closely studied her hidden secrets, the animals of the old stuffers resemble anything but that which they are intended to represent. It would appear that the study of nature was not deemed to be essential, and that imagination took its place and was allowed great latitude in the putting up of the stuffed effigies; so much so, that the living prototype would have recoiled in horror from the contemplation of its defunct representative. The older taxidermists had evidently to direct their entire attention to overcoming the difficulties presented by the material, the preservation of which was the main point. At first they contented themselves with removing the intestines and the brain, especially in birds; they then attempted to prevent the putrefaction of the remaining parts, by exposing the bodies to a gradually increasing temperature, for the purpose of expelling all the water. But, however carefully the drying was attended to, it is evident that these productions were of an ephemeral character, as they afforded a tempting prey to many descriptions of insects. An improvement was next effected by removing the large fleshy muscles, the entire skeleton still remaining. At present,

the skin alone is preserved; all parts that rapidly undergo putrefaction being carefully removed. By this means, and by the aid of modern chemistry, which has yielded a series of useful preparations to the taxidermist, the putrefaction of the stuffed animals is prevented. The operator is consequently enabled to direct his attention to other points of great importance; and, from the moment of being freed from anxiety respecting the preservation of his subject, he strives to perfect his mode of representing nature, and thus completely alters the range of his art. The skin of the animal has now become, in the hands of the taxidermist, a crude material, to be endowed with form and life-like attributes, as the marble under the chisel and mallet of the sculptor; and unless, like him, he prepares his mind by anatomical studies, and a close observation of nature, he will surely fail to realize a satisfactory production. The works of art—for, to many of the specimens the term might be well applied—exhibited in this department, proved that animal stuffing had been cultivated with unequivocal success.

Among the many interesting specimens of stuffed animals which we noticed in the Great Exhibition, one of the most remarkable was an elk, from the zoological museum at Turin. It exhibited to perfection the art of representing the living animal, not only in its general form and character, but marking also the fine and delicate undulations of the flesh and muscles, and all the anatomical details which are externally traceable. The difficulty of effecting this is so great that in general it is scarcely attempted; but in the present instance the artist was completely successful. The process adopted by Sig. Comba, the exhibitor of this specimen, was that of modelling the animal in clay, and from that model forming a mould; which mould enabled him to construct a figure of a material resembling papier-maché, retaining all the fidelity of the original model; upon this figure the skin is stretched.

The number of British exhibitors was thirteen, among whom the following deserved especial notice. A. D.

Bartlett exhibited an ingenious example of the art in the constructed figure of the Dodo—a bird which was once a native of Mauritius, and found there in considerable numbers at the beginning of the last century; but which now, as far as is known, is entirely extinct. The drawings of Savery, preserved in the Belvedere at Vienna, and in the Royal Gallery at Berlin, and some remains of a skeleton, formerly in the collection, already alluded to, of Elias Ashmole, consisting now but of the head and one foot, are the data from which the figure has been compiled. The process is of course very different from that of preserving a real animal, the skeleton and skin of which are entire; an artificial body has to be constructed, and then covered, feather by feather, with such plumage as is most in accordance with our knowledge of the bird. This was very skilfully executed; and the result, by the testimony of Mr. Strickland, and of Mr. Gray of the British Museum, "represented with great accuracy the form, dimensions, and colour of the Dodo, as far as these characteristics can be ascertained from the evidences which exist, whilst it reflected great credit on Mr. Bartlett's skill, and his practical acquaintance with the structure of birds."

There were other specimens exhibited by Mr. Bartlett, which were perhaps more attractive, inasmuch as they represented nature with a fidelity of which all could judge. The pair of Impeyan Pheasants, entitled "Courtship," and the sleeping Ourang-outan, "Repose," were especially deserving of notice. The fleshy parts of the latter were very skillfully treated; and the dried and shrivelled appearance which they so often assume was entirely avoided.

J. A. Hancock, of Newcastle, exhibited, in the North Transept, some beautiful examples, not only of a faithful and spirited adherence to life and nature, but of a skilful and harmonious combination of forms and colours. The three illustrations of hawking, and the scene in the tropics will go far towards raising the art of Taxidermy to a level with other arts, which have hitherto held higher

pretensions. The first of the three objects, illustrating the ancient sport of falconry, was the Hooded Hawk, looking lean and hungry, with the strap attached to his leg, by which he is held on the falconer's fist. In the second group, the falcon has struck to the ground, and is in combat with the *Quarry*, a powerful heron, who is struggling in vain against the attacks of his enemy; whilst the eel, which, but for the interposition of the hawk, would have been soon devoured by the heron, is quietly making his escape. The third tableau exhibited the gorged falcon; what a contrast was here presented! the blood-thirsty enemy of the heron is scarcely to be recognised in the drowsy figure; standing on one foot, the other being drawn up under his breast, the eye half-closed, he is the very image of gluttony. The tropical group comprised cockatoos and parrots, disporting in a rich tropical vegetation, with brilliant butterflies and beetles, lizards, and other reptiles. The stolid, heavy, self-satisfied expression of the parrots was well brought out by comparison with the anxiety and trepidation of the Mate of the Dead Gull, in another group; or, with the restless gaze of the Lämmergeyer of the Alps. The contrast between life and death was also well kept up, by the display of a group of dead game, the ruffled state of the feathers being exceedingly truthful.

C. Gordon exhibited a representation of an owl "mobbed by small birds," in which the action of the owl and of his tormentors was given with great liveliness and fidelity. A dog, exhibited by Dr. Beevor of Newark, prepared much in the same way as the elk contributed from Sardinia, was deserving of favourable notice. J. Leadbeater exhibited an instructive and curious collection of Indian gallinaceous birds; and an extensive collection of humming-birds, comprising about 300 or 400 varieties, in the North Transept, which were most beautifully set up. A brilliant assemblage of richly-plumaged birds from various parts of the world were also exhibited by Messrs. T. Williams and Gardiner. They were, however, apparently of a class

rather for the drawing-room than the cabinet of the naturalist. Those denizens of the air were chiefly selected which were most distinguished for the brilliant colouring of their plumage; and, so far as the careful preservation of it was concerned, they deserved commendation; but in respect to a delineation of the habits of the birds by approximate scenery, they fell short of the excellencies attainable in this art.

We have already in a former chapter briefly alluded to the collection of stuffed animals from Wurtemburg. As, however, the subject was so popular in the Great Exhibition, it will, perhaps, be not altogether unacceptable, at least to the more juvenile portion of our readers, if we again refer to the subject.

> "We shall not ask Jean Jacques Rousseau
> If birds confabulate or no;"

It is enough for us that from the days of wise Æsop to those of Fontenelle and Gay, they have been supposed to do so; and the learned Dean of St. Patrick, in his immortal Gulliver, has sanctioned the same idea: we shall therefore without further preamble, encouraged by the sage remark of our friend Horatius Flaccus,—

> "Dulce est desipere in loco,"

indulge, for a time, our more mirthful propensities in an investigation of the "Comicalities," if we may so term them, exhibited by the playful imagination of Hermann Ploucquet; who, besides an amusing display of numerous lively and spirited groups of birds, weasels, cats, hares, and other animals, in a variety of laughable situations, also illustrated, from the designs of Kaulbach, the story of "Reynard the Fox," a work which in Germany is as popular as our "Jack the Giant-killer." Carlyle says, "Among the people it was long a house-book, and universal best-companion; it has been lectured on in universities, quoted in imperial council-halls; it lay on the toilets of princes, and was thumbed to pieces on the bench of the artizan." We

shall proceed *seriatim* to describe the several points of action which our taxidermist laid before an admiring public.

In the opening scene we beheld the hero of the piece at home in his castle of Malepardus, reposing on a couch, and apparently ignorant of the heavy crimes that were brought against him at the royal court of the lion. One of these delinquencies was told in the next group, which represented the fox as a penitent hermit with his rosary, imposing upon a credulous cock, who, "with spectacles on nose," was perusing a forged document from the king of beasts, to the subsequent destruction of a part of his feathered brood. We read in our old English version of this tale how the fox was next summoned to the court of his royal master, and how Bruin, the bear, in an evil hour, undertook to bring the false knave into the hall of justice. Reynard, however, by an ingenious stratagem, defeats his enemy, and sends him back discomfited and sorely wounded. The wrath of the lion may be easily imagined at the insult offered to his messenger; taking wiser counsel, however, he despatches Sir Tibert, the cat, to bring the offender before his royal presence. The wily fox is, nevertheless, more than a match for his subtle betrayer, and, pretending to introduce the unwary grimalkin into the priest's barn on a mouse-catching party, decoys the poor cat into a trap; where, being mistaken for the fox, he is sorely beaten by the priest and his servants, and barely escapes with his life to tell his tale of grievance to the incensed king. A variety of similar attempts and similar failures to secure the culprit are next recorded in this amusing tale, until at length Reynard, bothered out of his life, resolves to go to court at once, which he accordingly does, and pretends he is acquainted with a hidden treasure, the possession of which he can secure to his majesty. Accordingly, in the next group we behold him dragging on Kyward, the hare, a reluctant witness to his statement. The king, blinded by his avarice, is easily imposed upon; he therefore pardons the fox, who, to get entirely out of the king's way, pretends that he has been excommuni-

cated, and that it is necessary he should go on a pilgrimage to Rome. We accordingly next behold him on his way to the eternal city with staff and beads, devoutly meditating. After a variety of adventures, however, he arrives at his own castle of Malepardus, before which, in the last group, we behold him inflicting signal punishment on Laprell, the rabbit, for having betrayed him to the king, who naturally showed himself greatly incensed at Reynard's falsehood and duplicity. The fox, however, finally contrives to get out of all his difficulties; and, according to our sage chronicler, he passes the remainder of his days in peaceful prosperity.

Besides this amusing episode of "the fox," M. Ploucquet exhibited two large hunting scenes, such as form the subject of Snyder's pictures; one, an attack of dogs upon a wild boar; the other, a stag pulled down by hounds. These evinced great spirit, and a close study of nature; although, in one or two instances, the action of the limbs and muscles were not minutely correct. These inaccurcies, however, were so few and so slight that they could not be considered to detract from the very great merit which belonged to the whole of M. Ploucquet's exhibition. The process employed by M. Ploucquet in preparing some of his smaller specimens, was to mould the figure of the animal in plaster of Paris, and to stretch the skin upon the model; and it proved most successful. The groups of M. Ploucquet attracted by far the largest share of public attention.

There were twenty-six exhibitors of taxidermy, of whom four received prize medals, and one obtained honourable mention.

ETHNOGRAPHICAL MODELS.

Under this title we shall describe a few collections of small figures illustrative of foreign costumes and manners. These, apart from their excellence as works of art, possessed a very high interest, as conveying, through the eye, a vivid representation of the customs, occupations, and habits of the natives of distant countries not so easily

apprehended from any written description, however well illustrated by drawings. These models were confined to the Court of the Fine Arts, with the Maltese, the Indian, and the Spanish Courts. Those contained in the first-named department attracted by far the largest share of public attention; although in respect of the particular excellence which was there contemplated, they possessed, perhaps, less interest than the very diversified and most extensive series in the Indian Court.

United Kingdom.—The Fine Art Court contained a collection of very beautiful, life-like, and spirited figures, modelled in wax, with most surprising minuteness and artistic feeling, both in the position and grouping. They represented the natives of Mexico, and also the American Indians habited in their proper costume, and displaying their characteristic customs in the several phases of civilized and savage life, with a truthfulness, in the varied expressions and anatomical development of the different effigies, which was most remarkable. An Indian, rejoicing in triumph over the despair of a white victim, whom he had bound and was about to scalp, but whose sufferings he was prolonging with savage cruelty, might be especially cited in illustration of this particular excellence; and the group of three figures, entitled "a confessional," as an instance displaying a rich vein of humour. The *Aquador*, or water-carrier; the *Ramendor*, or street-cobbler, in his tattered garments; the group of civilized Indians, laden with produce; the group of savage Indians, called *Mecos;* the *fandango*, a national dance, illustrated by two Indian women dancing to the guitar, played by a male figure, with numerous other examples which might be adduced, were also all deserving of equal praise.

India.—The figures in the Indian Courts, which were contributed by several exhibitors, were either modelled in clay or plaster, or else carved in wood, and painted to represent the natural colours of the various objects. The largest group, which was contributed by Mr. Mansfield, of the East India Company's Civil Service, was contained in a

model of the *Jamma Bundi;* or the encampment of a government collector, whilst moving about on his annual tour through his district. The figures were of plaster, and the buildings of wood. The double-poled tent of the collector was pitched at a short distance from the village; and he was represented as sitting within it, surrounded by the *Mauletdar* and other revenue-officers. Several petitioners were congregated round the door of the tent, soliciting a remission of part of the payments due from them. The figures of men and females and animals were about 300 in number, and presented a lively representation of Indian life and character. Some were indolently lying under the trees, some were gazing at the performance of a snake-charmer, and some feeding an elephant; whilst others, more intent on the business of the day, were having their petitions written out by the village accountants, or *Coolkurnees.* The village near which the encampment was formed, was represented inside a fortified wall which surrounded it, and which was shown in sections. There were also to be seen the numerous shops and rows of houses in the village, with the inhabitants engaged in their various pursuits.

The best executed and most instructive models, however, were those of clay, manufactured in Kisnaghur, representing the various castes and professions of the Hindoos; which collection comprised upwards of sixty illustrations, some consisting of several figures. Here, almost in closest juxta-position with splendid cotton-carding, spinning, and weaving machinery, there was to be seen a Bengal woman cleaning cotton with the strung-bow, and another spinning with the most primitive of apparatus; and the weaver preparing his thread on his roughly-made loom. Not far from Nasmyth's steam-hammer, the *Khamar,* or Bengal blacksmith, was represented with his simple bellows, forge, and anvil; and within a very short distance from the latest refinements in agricultural implements and machinery, were illustrations of ploughing and harrowing with apparatus which no European could use, and rice-

grinding, that must have required all the patience of an Indian to perform. On a line with the locomotive engines, which convey our correspondence with a celerity not dreamed of a few years since, and even now insignificant in comparison with the lightning speed of the electro-telegraph, were effigies of the *Dawk-runner*, or bearer of the government mail-bags; and the *Dawk-bundy-burdar*, or messenger who carries post-office parcels; and closely watched by the unarmed policeman, were the *Bro-jabassee*, or armed watchman, and the *Chowkeedar*, or village watchman. These were only a few of the groups of this most suggestive and well-executed collection.

Less perfect in point of execution than the Kisnaghur clay figures; but still most interesting, were the models manufactured at Gokak, which it appears are not made as articles of export, but only to order. This collection comprised about forty illustrations, out of which might be especially noticed, as representing trades, the cotton-printer, the potter, the woman grinding meal, the Bengal water-carrier, or *Bheestee*, and the washerwoman or *Dhobie*.

The models illustrating the practices of the Thug murderers, excited the most painful interest, and represented the following incidents: a traveller, induced to sit down and smoke, has his attention directed to the heavens, when the fatal handkerchief is applied by a Thug, who stands behind him; but in another group a horseman was successfully defending himself from an attack on the part of the Thugs, one of whom he had slain. The mutilation of the bodies of the murdered, and their concealment in a well, and the strangling of travellers on horseback and on foot, were also represented. It is stated that some of these Thug murderers, after having been arrested and reclaimed, and domiciled in a school of industry, were the manufacturers of the carpets exhibited in the Indian tent. The other models contained in the Indian Court comprised thirty-five figures in wood from the Rajah of Joudpore; a model of a European court of justice, and also one of a

native court; models of a silk factory and an indigo factory, of a native oil mill, and of a farm establishment. A series of male and female figures, exhibited by T. E. J. Boileau, represented the principal sects in Cochin China and Travancore.

Malta.—The figures from Malta, which were modelled in wax, had not the same claims to merit as those before described, but had still a certain amount of excellence. They represented the Grand Master Valetta, the Grand Master Lonzadari, with the Master of the Order of Malta, and a knight, in their proper costume.

Spain.—Three exhibitors contributed models illustrative of the manners and dresses of Spain. Two of these sent figures in painted terra-cotta, representing the inhabitants of Andalusia and Malaga; but the examples were not numerous, though they were remarkable for the beauty and correctness of the modelling. The other exhibitor sent a model of one-half of the interior of the arena for bull-fights at Madrid, made in wood, and containing, it was said, about 4,000 figures, exhibiting the various incidents proper to the place.

The number of exhibitors from various countries was eleven, of these four received prize medals, and one honourable mention.

CHAPTER XX.

ALLIANCE OF SCIENCE AND INDUSTRY.

DR. LYON PLAYFAIR—FAVOURABLE RESULTS OF THE GREAT EXHIBITION—COMPARISON BETWEEN ENGLISH AND CONTINENTAL MANUFACTURES—OUR NATIONAL DEFICIENCIES CONSIDERED—CLASSICAL LITERATURE — INFINITY OF SCIENCE —TRUE CAUSE OF BRITISH SUPERIORITY — SCIENCE THE NATURAL DESIRE OF THE HUMAN MIND—OPINIONS OF EOTHEN —CENTRAL COLLEGE OF ARTS AND MANUFACTURES IN PARIS —INDUSTRIAL UNIVERSITY PROPOSED—THE THREE LEARNED PROFESSIONS—INDUSTRY A PROFESSION—SIR H. DAVY ON SCIENCE AND PATRONAGE—QUOTATION FROM LORD BACON— COMPETITION—FUTURE PROGNOSTICS—THE EXHIBITION A SCHOOL OF INDUSTRY, ETC., ETC.

It was a wise and useful suggestion of Prince Albert's, that our most eminent philosophers should be engaged to deliver a series of lectures on the subject of the Great Industrial Exhibition, before the Society of Arts. We have already given copious extracts from the admirable Inaugural Discourse by Dr. Whewell, and we now propose, in the present chapter, to offer a few of equal importance from the no less admirable lecture of Dr. Lyon Playfair. "A rapid transition," observes the learned doctor, "is taking place in industry; the raw material, formerly our capital advantage over other nations, is gradually being equalised in price, and made available to all by the improvements in locomotion: industry must in future be supported, not by a competition of local advantages, but by a competition of intellect. All European nations, except England, have recognised this fact; their thinking men have proclaimed it; their governments have adopted it as a principle of state; and every town has now its schools, in which are taught the scientific principles involved in manufactures, while each metropolis rejoices in

an industrial university, teaching how to use the alphabet of science in reading manufactures aright. Were there any effects observed in the Exhibition from this intellectual training of their industrial populations? The official reserve, necessarily imposed upon me as the commissioner appointed to aid the juries, need exist no longer, and from my personal conviction, I answer, without qualification, in the affirmative. The result of the Exhibition was one that England may well be startled at. Wherever—and that implies in almost every manufacture—science or art was involved as an element of progress, we saw, as an inevitable law, that the nation which most cultivated them was in the ascendant. Our manufacturers were justly astonished at seeing most of the foreign countries rapidly approaching and sometimes excelling us in manufactures, our own by hereditary and traditional right. Though certainly very superior in our common cutlery, we could not claim decided superiority in that applied to surgical instruments; and were beaten in some kind of edge-tools. Neither our swords nor our guns were left with an unquestioned victory. In our plate-glass, my own opinion—and I am sure that of many others—is, that if we were not beaten by Belgium, we certainly were by France. In flint-glass, our ancient *prestige* was left very doubtful, and the only important discoveries in this manufacture were not those shown on the English side. Belgium, which has deprived us of so much of our American trade in woollen manufactures, found herself approached by competitors hitherto almost unknown; for Russia had risen to eminence in this branch, and the German woollens did not shame their birth-place. In silversmith work we had introduced a large number of foreign workmen as modellers and designers, but, nevertheless, we met with worthy competitors. In calico-printing and paper-staining our designs looked wonderfully French; whilst our colours, though generally as brilliant in themselves, did not appear to nearly so much advantage, from a want of harmony in their arrangement. In earthenware we were masters, as

of old; but in china and in porcelain our general excellence was stoutly denied; although individual excellencies were very apparent. In hardware we maintained our superiority, but were manifestly surprised at the rapid advances making by many other nations. Do not let us nourish our national vanity by fondly congratulating ourselves that, as we were successful we had little to fear. I believe this is not the opinion of most candid and intelligent observers. It is a grave matter for reflection, whether the Exhibition did not show very clearly and distinctly that the rate of industrial advance of many European nations, even of those who were obviously in our rear, was at a greater rate than our own; and if it were so, as I believe it to have been, it does not require much acumen to perceive that in a long race the fastest-sailing ships will win, even though they are for a time behind. The Exhibition will have produced infinite good, if we are compelled as a nation to acknowledge this truth. The Roman empire fell rapidly, because, nourishing its national vanity, it refused the lessons of defeat, and construed them into victories. All the visitors, both foreign and British, were agreed upon one point, that, whichever might be the first of the exhibiting nations, regarding which there were many opinions, that certainly our great rival, France, was the second. Let us hope that in this there is no historical parallel. After the battle of Salamis, the generals, though claiming for each other the first consideration as to generalship, unanimously admitted that Themistocles deserved the second; and the world, ever since, as Smith remarks, has accepted this as a proof that Themistocles was, beyond all question, the first general. Let us acknowledge our defeats when they are real, and our English character and energy will make them victories on another occasion. But our great danger is, that, in our national vanity, we should exult in our conquests, forgetting our defeats; though I have much confidence that the truthfulness of our nation will save us from this peril. A competition in industry must, in an advanced state of civilisation, be a

competition of intellect. The influence of capital may purchase you for a time foreign talent. Our Manchester calico-printers may, and do, keep foreign designers in France at liberal salaries. Our glass-works may, and do, buy foreign science to aid them in their management. Our potteries may, and do, use foreign talent both in management and design. Our silversmiths and diamond-setters may, and do, depend much upon foreign talent in art and foreign skill in execution; but is all this not a suicidal policy, which must have a termination, not for the individual manufacturer, who wisely buys the talent wherever he can get it, but for the nation, which, careless of the education of her sons, sends our capital abroad as a premium to that intellectual progress which, in our present apathy is our greatest danger?

"It is well to inquire in what we are so deficient, and what is the reason of this deficiency. Assuredly it does not consist in the absence of public philanthropy or want of private zeal for education, but chiefly rests in that education being utterly unsuited to the wants of the age. In the thirteenth and fourteenth centuries, classical learning was, after its revival, highly esteemed; and its language became the common medium for expression in all nations. A thorough acquaintance with it was an absolute necessity to any one with pretensions to learning. It had a glorious literature, one as fresh as when it grew on the rich soils of Rome and Greece. Its truths were eternal, and were received by us in their traditional mythology, as Bacon beautifully says, like "the breath and purer spirit of the earliest knowledge floating to us in tones made musical by Grecian flutes." And why was that bewitching literature made the groundwork of our educational systems? Does it not show that literature, like art, may have a standard excellence; and that we are content to imitate where we cannot surpass. If the main object of life were to fabricate literati, I would not dispute the wisdom of making classics the groundwork of our education. They are not utterly dead, but, like the dry bones of the valley, they

may come together, and have breathed into them the breath of life. In the world there is a constant system of regeneration. Theories exist for a time, but like the phœnix, are destroyed, and rise yet more glorious from their ashes. Animals die, and by their decay pass into the atmosphere, whence vegetables derive their nutriment, and thus death becomes the source of life. But in all this there is no incongruity. A phœnix does not from its ashes produce an eagle, but a phœnix as before. The dry bones of dead literature may vivify into new forms of literary life. Classical literature and exact science, are, however, wholly antithetic. If classical literature be sufficient to construct your spinning-jennies and bleach your cottons, your system of instruction is right; but if you are to be braced, and your sinews strengthened for a hard struggle of industry, is it wise that you should devour poetry, while your competitors eat that which forms the muscles and gives vigour to the sinews? With such different trainings, who in the end will win the race? Science has not, like literature and art, a standard of excellence. It is as infinite as the wisdom of God, from whom it emanates. All ordinary powers decrease as you depart from the centre; but the power of knowledge augments the farther it is removed from the human source from which it was transmitted. God has given to man much mental gratification in trying to understand and apply to human uses His laws. The great philosopher of scripture has said, "It is the glory of God to conceal a thing, but the honour of kings to search out a matter." The poet-prophet of the Bible has also told us, that God "turneth wise men backward, and maketh their knowledge foolish." And, therefore, assurely as He is infinite and man finite, until earth passes away, you will have no human standard of scientific knowledge. As this is so, how can we as a nation expect to carry on those manufactures by our sons of industry, when we do not teach them the nature of the principles involved in their successful prosecution? Solace ourselves as we will with vain

thoughts of our gigantic position among nations—Greece was higher than we are, and where is she now? It does not require a lofty stature to see the farthest; for a dwarf on the shoulders of a giant sees farther than the giant,—not that he is less a dwarf, but that he has added the giant's height to his own. The Exhibition showed us many small states which had thus raised themselves on the shoulders of science within the last few years, while we are merely hovering about its skirts. Let us take care that our excess of pride in the so-termed "practical" power of our population may not be punished as Arachne was of old. Arachne was wonderfully skilled in needlework, but presumptuously challenged Minerva to a trial of skill. What chance was there in such an unequal contest? Minerva united science to her handicraft skill, and this combination insured success. Arachne was justly cast from her proud position among mortals by being changed into a spider, ever spinning the same web in the same way,—the same for wintry blasts as for gentle summer zephyrs.

"'You have excelled all other people in the products of industry. But why? Because you have assisted industry by science. Do not regard as indifferent what is your true and greatest glory. Except in these respects, in what are you superior to Athens and Rome? Do you carry away from them the palm in literature and the fine arts? Do you not rather glory, and justly too, in being, in these respects, their imitators? Is it not demonstrated by the nature of your system of public education and by your popular amusements? In what, then, are you their superiors? In everything connected with physical science; with the experimental arts. These are your characteristics. Do not neglect them. You have a Newton, who is the glory, not only of your own country, but of the human race. You have a Bacon, whose precepts may still be attended to with advantage. Shall Englishmen slumber in that path which these great men have opened, and be overtaken by their neighbours? Say, rather, that all

assistance shall be given to their efforts; that they shall be attended to, encouraged, and supported.' "—*Davy*.

"All the aspirations of youth are towards science, especially that depending on observation, but we quench the God-born flame by 'freezing drenches of scholastic lore.' In the language of 'Eothen,' 'You feel so keenly the delights of early knowledge! You form strange mystic friendships with the mere names of mountains, and seas, and continents, and mighty rivers; you learn the ways of the planets and transcend their narrow limits, and ask for the end of space; you vex the electric cylinder till it yields you, for your toy to play with, that subtle fire in which our earth was forged. You know of the nations that have towered high in the world, and the lives of men who have saved whole empires from oblivion. What more will you ever learn? Yet the dismal change is ordained, and then, thin meagre Latin (the same for everybody) with small shreds and patches of Greek, is thrown, like a pauper's pall, over all your early lore; instead of sweet knowledge, vile, monkish, doggrel grammars and graduses, dictionaries and lexicons, and horrible odds and ends of dead languages, are given you for your portion, and down you fall from Roman story to a three-inch scrap of '*Scriptores Romani*'—from Greek poetry, down, down, to the cold rations of '*Poetæ Græci*,' cut up by commentators and served out by schoolmasters.' Is this horrible quenching of all our youthful innate love of God's truth, the education for the youth of a nation, depending for its progress on their development? How is it possible that dead literature can be the parent of living science and of active industry?

"I need not explain myself as meaning that our youthful aspirations point to science as a fit means for developing our intellectual capacities, and that boyhood is scarcely the time rudely to exercise all our longings for an acquaintance with the wisdom of creation, or to cramp and torture the mind by the acquisition of dead languages to the exclusion of all other knowledge. In quoting the

beautiful language of '*Eothen*,' I intend only to express the violence done to our natural instincts, and not to question the excellence of the means employed in teaching classics. It would ill become me, or any one, to speak disparagingly of the wisdom to be derived from a study of ancient authors, or to deny the immense importance of a knowledge of classical literature to education generally; nor should I like to see that education confined to stern realities, divested of the graces and poetry of polite literature. But I do, at the same time, vehemently protest against the exhaustion of all our youthful years by a mere classical tuition, especially in the case of that large class of the community who, by their exertions in industry, have confided to them, in a great degree, the prosperity of their country. As I do not think the teaching of classical literature, as practised in our schools, to be worthy of the name of education, neither do I apply that title to the communication of scientific knowledge alone—and you will observe that I have always spoken of it by the term 'instruction.'—I am propounding no scheme of education, but strongly insisting that instruction in science should form an important part of the education of our youth.

"Do not conceal from yourselves that this is the vital difficulty of the question. You may, and I hope will, soon raise an Industrial University; but this should have its pupils ready trained before it adopts them. Now, it must from itself act downwards, instead of working from the schools upwards. Until our schools accept as a living faith that a study of God's works is more fitted to increase the resources of the nation than a study of the amours of Jupiter or of Venus, our industrial colleges will make no material headway against those of the continent. In Paris we find a Central College of Arts and Manufactures, into which the students enter at an average age of nineteen years, already well trained in the elements of science, and going there to be taught how to use these elements for industrial application. Three hundred of the best youth

of France are annually receiving at this college the most elaborate education; and the best proof of its practical value is the great demand among manufacturers for its pupils, a diploma from it being equivalent to assured success in life. Can you wonder at the progress making by France in industry, when she pours every year an hundred and fifty of these highly educated manufacturers into her provinces? A similar education to this is going on in almost all parts of Europe; but in England only one such institution exists. We have our University and King's College, it is true, and they are productive of much good, and similar colleges exist in Scotland and Ireland; but their instruction in science terminates just where the industrial colleges of the continent begin. In fact, the latter would be supplementary and a great support to the former. Government, acting on its own perception of right, in its first national recognition of these truths, now happily dawning on England, has established a school of mines; and the experience of this has shown that it is much appreciated, although it labours under the disadvantage of the want of a preliminary education in its pupils—compelling its professors, in its commencement, to be more elementary in their instruction than is well compatible with the proper objects of such a school. Now, while I urge the impolicy of a mere classical instruction to the youth of this country with all the expression which I can give to a matured conviction, do not suppose that I would wish to put all our youth in one Procrustean bed. I again allege, that it is the present system which follows this singular love of uniformity, and clips or extends the dimension of each youth to one common standard. It is against this very confined system that I protest. I think the glorious wisdom displayed in creation, even in the limited extent to which we are permitted to behold it, forms no unapt means of leading man to a worship of its Creator; and, sympathizing as I do to the utmost in our educational endeavours to unite and not to dissever the acquirement of knowledge from that of religion—a union

which, I think, is at once the glory, the pride, and the peace of England—I cannot perceive how the mere teaching of profane literature can tend to this end in any degree, so much as the reverential teaching of God's wisdom displayed in His works; especially when every step in advance of this knowledge produces a social amelioration of the human race. But, while I should regret to see our colleges retrograde one step in their teaching of classical literature, it is truly lamentable that Oxford and Cambridge so little encourage the sciences; for, until the colleges throw open their widest portals to these, the schools in the country, deriving their life from them, will do little to reform the present vices of a limited and exclusive education.

In this country we are, in many respects, remarkably unchangeable. Three professions—the church, the law, and medicine, were supposed, some centuries since, to represent learning, and, with a wonderful blindness, they are still accepted as all-sufficient. Industry, to which this country owes her success among nations, has never been raised to the rank of a profession. For her sons there are no honours, no recognised or social position. Her native dignity, if tacitly understood, has never formally been acknowledged. Science, which has raised her to this eminence, is equally unrecognised in position or honours, and, from her very nature, cannot attain the wealth which in industry solaces the absence of social position. This restriction of learned honours to three recognised professions has a lamentable effect both on the progress of science and of industry. Its consequence is, that each profession becomes glutted with ambitious aspirants, who, finding a greater supply than demand, sink into subordinate positions, becoming soured and disappointed, and therefore dangerous to the community. Raise industry to the rank of a profession—as it is in other countries—give to your industrial universities the power of granting degrees involving high social recognition to those who attain them, and you will draw off the excess of those

talented men, to whom the church, the bar, and medicine, offer only a slender chance of attaining eminence; and by infusing such talent into industry, depend upon it, the effects will soon become apparent. In foreign countries professions involving social rank and position arise with their requirements; in our nation we are content with a meagre classification, scarcely sufficient for the middle ages, and not even a reflection of our present wants. These considerations are not mean ones, for, as long as ambition exists in the human mind, their good or bad adjustment will exercise a beneficial or pernicious influence on society.

"In the establishment of institutions for industrial instruction, you, at the same time, create the wanting means for the advancement of science in this country. I have alluded in this lecture, and have shown in another, that the progress of science and of industry in countries which have reached a certain stage of civilisation ought actually to be synonymous expressions; and hence it follows that it is essentially the policy of a nation to promote the one which forms the springs for the action of the other. I think it, therefore, no mean advantage to this nation, that the establishment of industrial colleges will materially aid the progress of science by creating positions for its professors and for those who would willingly cultivate science, but are scared from it by the difficulties they have to encounter in its prosecution. The great Davy says, 'Science, for its progression, requires patronage; but it must be a patronage bestowed, a patronage received with dignity. It must be preserved independent. It can bear no fetters; not even fetters of gold; and, least of all, those fetters in which ignorance or selfishness may attempt to shackle it. And there is no country which ought so much to glory in its progress, which is so much interested in its success, as this happy island. Science has been a prime cause of creating for us the inexhaustible wealth of manufactures; and it is by science that it must be preserved and extended. We are interested as a commercial

people—we are interested as a free people. The age of glory of a nation is likewise the age of its security. The same dignified feeling which urges men to gain a dominion over nature will preserve them from the dominion of slavery. Natural, moral, and religious knowledge are of one family, and happy is the country and great its strength where they dwell together in union.' Let me quote, also, from the immortal Bacon on this point—who, as lord chancellor, when he wrote could not be actuated by personal ambition,—'And as founders of colleges plant and founders of lectures water, we must next note a defect in public lectures, whether in arts or professions, viz., the smallness of the salary generally assigned them, for it is necessary to the progress of the sciences that lecturers be of the ablest kind, as men intended for propagating the sciences in future ages and not for transitory use. And this cannot be, unless the profits content the most eminent in every art to appropriate their lives and labours to this sole purpose, who must, therefore, have a competency allowed to them proportionable to what might be expected from the practice of a profession. For, to make the sciences flourish, David's military law should be observed—"that those who stay with the stores have equal with those who are in the action," or otherwise the stores will be ill-attended; so lecturers in the sciences, as being the guardians of the stores and provisions, whence men in active life are furnished, ought to share equal advantages with them; for, if the fathers of the sciences be weak or ill-maintained, the children will feel the effect of it.' I will not weaken this admirable opinion of Bacon by any remark of my own, for I believe it to contain the real cause of the low state of science in England. But, lest you should think my views partake too much of the *argumentum ad sacculum*, I will protect myself under the caustic wit of Diogenes, who, on being asked, 'How it happened that philosophers followed the rich and not the rich the philosophers?' answered, 'Because the philosophers know what they want, but the rich do not.'

"I must now conclude this lecture, already much too long, and I do so by once more recalling to your minds its general argument. Chemistry, viewed here as a type of science generally, has exercised immense influence upon manufactures, having increased human power, economised human time, and communicated important values to bodies apparently the most worthless. Foreign states have acknowledged the fact, that successful competition can only be attained by an attentive study of science—by making their sons of industry themselves disciples of science. England, except in one instance, has hitherto not recognised this truth as a principle of State, and hence her science languishes, and her capital has to import from other lands. This points to the necessity of the establishment of industrial colleges; but it implies, at the same time, an adaptation of juvenile education to the wants of the age. All this impresses itself upon my mind with a conviction as strong as that the glorious sun sheds its light-giving rays to this naturally dark world of ours. May the Exhibition be the means of raying forth this truth to our darkening industry! Do not dream of that Exhibition as a thing of the past; rather think of it as a glorious emblem of the future. When Neptune and Minerva disputed as to who should name the capital of Cecropia, the gods resolved that the right should be given to the one who granted to man the greatest benefit. Neptune struck with his trident the earth, from whence sprung a war-horse; while Minerva produced an olive-tree. England, though sharing with Neptune the empire of the sea, ratified the decision of the gods by rearing the emblem of peace. The Exhibition has been an olive-tree, the branches of which have now been spread among all nations, and success for the future will depend upon the care and wisdom with which they are tended, so as to grow into goodly trees. Do not let us, by severing industry from science, like a tree from its roots, have the unhappiness of seeing our goodly stem wither and perish by a premature decay; but, as the tree itself stretches out its arms to

heaven to pray for food, let us, in all humility, ask God also to give us that knowledge of His works which will enable us to use them in promoting the comfort and happiness of his creatures. Our duties in this respect are clearly indicated in the motto of our catalogue:—

'HUMANI GENERIS PROGRESSUS
EX COMMUNI OMNIUM LABORE ORTUS,
UNIUSCUJUSQUE INDUSTRIÆ DEBET ESSE FINIS:
HOC ADJUVANDO,
DEI OPT: MAX: VOLUNTATEM EXSEQUIMUR.'"

THE EXHIBITION AS A SCHOOL OF INDUSTRY.

To pursue the difficult question of the tendency of mechanical production, and the influence of increased facilities upon the condition of the workman, would involve us in a greater length than we propose in this present chapter. Unquestionably, the immediate results are often suffering and hardship to individual workmen, and often to a whole trade. But we cannot quite address ourselves to the logic of arguments, that improved modes of production, which confessedly place the article within the reach of a greater number, are to be retarded, in order to benefit a minority; that the course of science is to be checked; that knowledge is baneful; and that either particular modes of production, or particular habits and manners in men, are to be kept up solely for the existence of particular trades and particular classes of artisans. Moreover, those who enter into these arguments are prepared to show, that the social machine rights itself in a much shorter time than might have been anticipated. We well recollect the fearful prognostications at the commencement of the railway system. Caricatures of distracted innkeepers and delighted horses were to be seen; and what was shown in caricature was true at least for the time, as to the innkeepers. The coaching glories of Lichfield, Northampton, and St. Alban's, passed to places which had been too small to dread railways; new towns rose with wonderful rapidity, and the old became melancholy

and deserted. We need not tell what every one knows; though let the artisan class bear in mind, that from the development of the railway system a great amount of new employment has been gained, and families once struggling against reverse of fortune are now contented and happy. And if we say the very innkeepers and horses had soon more to do than ever before, and that towns which had rejected railways got looped in, bitterly lamenting, then we shall have simply told the story of the last sixteen years. But the moral we cannot omit. It is, that the antidote to these temporary hardships must be supplied by education, by the development of mind in the workman; and for this antidote, the means existed in the Exhibition. By debasing the workman to a mere machine, it has followed necessarily that the human machine was superseded, sooner or later, by the superior mechanism which springs from mind. Immediate advantages of concentration of attention and subdivision of labour were the limitation; and it may not unreasonably be inferred, that the recent prevalence of insanity even has been the result. Improved education, and the development of mental energy, would not only lead to the discovery of new sources of employment, indispensable in a state of progress, but would, at the same time, substitute an honest pride and pleasure in the perfect execution of even mechanical work; the increasing want of which is a main cause of the inferiority of many works of art, and a constant source of annoyance to architects, and loss in buildings to the public. From the brickwork and joiner's work, or ironmongery in a house, down to a chair or an umbrella, lowness of price without the asserted durability, is universal; and the ingenuity, and even pleasure, which both dealers and workmen evince in the practice of a deception, is equalled by the readiness of the public to deceive themselves. As we cannot grasp the reasoning of a Chancellor of the Exchequer, that because chicory is sold, coffee has been available to a class which had not before used it, so we regret the prevalence of the delusion which

exists in buildings as in every other commodity. Many amongst the class of building artisans appear to disregard directions as to work, for the mere pleasure of practising a deceit. For this pleasure, we must substitute the pride of producing a good work, and this antidote, we repeat, was to be found in the Exhibition. We could have hoped that the influence of the Exhibition would have been exerted in the removal of a delusion before referred to, namely, that expense and elaborate work are indispensible to the production of beauty. Beautiful, indeed, and suggestive as were many of the objects of the Exhibition, there appears to have been an entire absence of that cheap beauty which would be within the reach of all classes. The attainment of this object would have been the more desirable, since recent attempts to extend the influence of art, in association with objects of decoration and utility, have fostered rather than discouraged the delusion, and so have not advanced the objects of those who have made them. What has to be done, in fact, is to invest every form of utility with the attributes of art, and this alike from the most elaborate work of architecture, to the least important article of furniture, or the meanest utensil. Certain principles which have to be kept in view are alike in all these cases. They correspond with those which the most enlightened artists are endeavouring to bring to the regeneration of architecture; they are in many respects distinct from those which determine the forms of painting and sculpture, and, perhaps, have never yet been accurately perceived and exemplified in the architecture of any age. They depend, indeed, upon the constant recognition of the fact, that the reason must be satisfied as well as the eye delighted; and the want of this recognition is the great fault in the numerous designs for decorative objects, now held up to notice as excellent works of art. We think that the late Exhibition has afforded us the means, not only of contributing to the advancement of architecture, but of placing it in a position in which it has never yet stood; but there are particluar circumstances in connexion with manufactured art which

should be guarded against, although not precisely in the manner urged by those who deny the value of multiplication of copies. As for the collection of grates, ironmongery, furniture, and all those objects which afford interest to the architect, they could not be viewed without advantage—since the greatest difficulty is often felt in obtaining knowledge of the existence of particular inventions and contrivances. As a complete collection of these things, the Exhibition was, of course, not to be regarded. It is from the uses of the Exhibition, on which we have dwelt above, that its chief value will be felt."

CHAPTER XXI.

DECORATIVE FURNITURE AND UPHOLSTERY, PAPER-HANGING, ETC.—*Juries' Reports.*

CABINET FURNITURE, EARLY ACCOUNT OF—ITALIAN, FRENCH, GERMAN AND ENGLISH WORK—FIRST INTRODUCTION OF MAHOGANY—MARQUETERIE INLAY—TARSIA-WORK—BUHL INLAY—MOSAIC INLAY — PARQUETERIE—PORCELAIN INLAY—MECHANICAL ACTION IN CABINET WORK—BILLIARD-TABLES—DECORATIONS — IMITATIONS OF WOODS AND MARBLES — PAINTED BLINDS—WAX-CLOTH HANGINGS—PAPER-HANGINGS, VARIOUS KINDS—MODE OF MANUFACTURE—MODE OF PRINTING—BEAUTIFUL SPECIMENS OF LANDSCAPE PAPERS, ETC.

It is important, both for strength and good effect of furniture, that the principles of sound construction be well carried out; that the construction be evident, and that, if carving or other ornament be introduced, it should be by decorating that construction itself, not by overlaying it and disguising it. It is not necessary that an object be covered with ornament, or be extravagant in form, to obtain the element of beauty: articles of furniture are too

often crowded with unnecessary embellishment, which, besides adding to their cost, interferes with their use, purpose, and convenience. The perfection of art manufacture consists in combining, with the greatest possible effect, the useful with the pleasing; and the execution of this can generally be most successfully carried out by adopting the simplest process.

The jury, though fully sensible of the great beauty of many of the ornamental works in furniture collected at the Exhibition, yet regret that there have not been more specimens of ordinary furniture for general use; works whose merits consist in correct proportion, simple but well-considered design, beauty of material, and perfect workmanship. Few have the means of purchasing such beautiful works as the sideboard of M. Fourdinois, or the cabinets of M. Ringuet-Leprince, which come almost under the head of fine art, rather than of manufacture; and it is much to be desired that attention be directed towards improving the taste of those more ordinary objects that come into daily use by the many.

Cabinet furniture first became an article of general luxury about the beginning of the sixteenth century. At this period inlaid, as well as richly-carved furniture, was manufactured in Italy, and exported to various parts of Europe. Among the works exhibited by Italy, some were distinguished by great excellence, particularly in the carved examples. M. A. Barbetti, from Florence, exhibited a casket of great merit, most elaborately carved, introducing bas-reliefs of figures, ornaments, chimeras, &c. A large cheval-screen frame, by Luigi Marchetti, of Sienna, was very beautifully wrought with delicate ornaments, of good taste. An oval medallion frame, by Pietro Guisti, was also a fine specimen of carving. M. B. Capello, of Turin, exhibited a very elegant inlaid table, a currule chair, and a pedestal—all ornamented in very pure taste, in the Etruscan style, and of good execution.

In France, ornamental cabinet work had acquired considerable reputation in the time of Louis XIV. Its manu-

facturers have, since then, continued to produce works of great beauty, and have brought the art of marqueterie inlay to a high state of perfection: this work consists in inlaying woods of a great variety of tints, in the form of flowers, ornaments, &c.; and was greatly advanced, in the last century, by Reisner, who produced very beautiful specimens. In buhl-work, also, wherein metals are inlaid upon grounds of tortoiseshell or ebony, or *vice versa*, the French have greatly excelled. This kind of ornamental inlay takes its name from M. de Boule, a celebrated French cabinet-maker, in the time of Louis XIV.

In Germany there has long been established cabinet-work of a high class, more especially for those exquisite ebony cabinets, inlaid with precious stones, and various woods and metals, surmounted with carved figures, and elaborately fitted with innumerable drawers and with perspective recesses—presents fit for kings and princes; of these an excellent example was presented in the ebony cabinet of M. Gröger, of Vienna, a most beautiful work, exquisitely finished.

Cabinet-work, of a more useful description has been carried to a high state of perfection in Great Britain, whose manufacturers have studied to produce objects in which the prominent excellence is substantial quality and finished workmanship. It was in England that mahogany, now so generally used, was first employed for cabinet furniture, about 1720. Dr. Gibbons, an eminent physician, having had some planks of this wood given to him by his brother, a West-India captain, who had brought them in his vessel as ballast, wished to use them for a house he was building, in King-street, Covent-garden; but the carpenters complained that the wood was too hard; it was therefore laid aside as useless. Soon after, Mrs. Gibbons wanted a candle-box, and the doctor called in his cabinet-maker, Mr. Wollaston, to make him one of this wood, then lying in the garden. He also declared that it was too hard. The doctor said he must get stronger tools. The candle-box was completed and approved, insomuch that the

doctor then insisted on having a bureau made of the same wood, which was accordingly done; and the fine colour, polish, &c., were so pleasing, that he invited his friends to come and see it. Among them was the Duchess of Buckingham. Her grace begged some of the same wood from Dr. Gibbons, to make a bureau for her also; on which the fame of mahogany and Mr. Wollaston was much raised. The wood became the fashion, was much admired, and from that time has continued to be used for furniture more than any other.

It will not be possible to give a description of the various details of the manufacture of cabinet-work; but an account of some of the more ornamental processes and results connected with it may be desirable. Of these the marqueterie inlay is one of the most beautiful and interesting. In this work the design, having been first drawn on paper, and properly coloured, is pricked with a fine needle, so that the outline of the ornament or other objects can be pounced on the various coloured woods proposed to be employed; these outlines being carefully marked in, are cut with a fine watch-spring saw, worked in a lathe; in most cases the wood forming the ground is cut with that forming the ornament, so that a piece cut out of white wood corresponds exactly, in shape and size, with the opening left in black wood, in which it therefore fits, and forms the required pattern.

Tarsia-work, or the art of inlaying woods, had been practised from a very early date in Italy, and extensively employed in the decoration of wall-panelling; and remains of this kind of work, revived by Fra Giovanni di Verona, in the fifteenth century, still exist in some of the Italian churches. The earlier specimens of this work were executed in woods of different shades, but natural hues; afterwards, when flowers, birds, and coloured ornaments were introduced, various stained woods were employed; these, in most cases, have the disadvantage of fading, but in the admirable specimens of marqueterie inlay exhibited by M. Cremer, of Paris, the woods were stained by the

process of M. Bouchenè, which gives them a permanent dye to a considerable depth. Notwithstanding, however, the beautiful effect of this work, it is desirable to adopt, as far as possible, the employment of woods of natural hues, as being more harmonious and more consistent with the nature of the work. In those ornaments which are shaded, the effect is given by immersing the pieces in hot sand. The various parts being cut, one of the required tints in the proper form are then placed according to the design, and fixed on paper; afterwards they are applied, like veneer, to the piece of furniture: being mounted, they are cleaned off, and slightly polished, and the finer lines are then engraved.

Buhl inlay is manufactured by exactly the same process, only that metals, tortoiseshell, and ebony, are here the materials employed; the nature of the design is somewhat different, depending more upon simple outline forms. There were many beautiful specimens of this kind of work in the Exhibition, more particularly the cabinets of M. Fortner, of Wurtzburg, Bavaria, where the figures and ornaments were designed and finished with infinite taste and skill. There is another kind of inlay applied to furniture, which may be called Mosaic inlay. The beautiful boxes made in India gave some good specimens of this work, in ivory and metal, equalled, however, by the inlaid furniture and boxes of M. Marcelin, of Paris. The extraordinary table of Se or Perez, of Spain, gave a fine example of this style of work, executed entirely in minute portions of wood; the same principle was carried out in a table, by Nye, of Tonbridge Wells. Where the patterns assume geometric forms, this kind of work is executed by laying together slips of wood or metal, &c., in the particular forms required; these united slips are then cut transversely, and affixed to the grounds as in marqueterie.

Immediately connected with inlaid cabinet-work is the manufacture of parqueterie, for floors; in this work the same principle is carried out as in marqueterie, only on a bolder scale: woods of different colours are cut to pattern,

and inlaid one in the other, or so arranged as to produce very beautiful effects for floors. The specimens exhibited of MM. Couvert and Lucas, and M. de Keyn, of Belgium; of MM. Leistler and Son, of Vienna; and of Mr. Miller, of Russia, showed the perfection to which this art has been brought.

A very beautiful novelty at the Exhibition was the introduction of porcelain inlaid in furniture, like marqueterie, by Messrs. Rivart and Andrieux; in these examples, not only were panels of porcelain inserted, but the painted flowers were cut to form, and inlaid like the ornamental woods. In the cabinet of Mr. Dowbiggin, of London, porcelain, of a very high class of art, was mounted in the panels and pilasters; and M. Gambs, of St. Petersburg, contributed a cabinet in tulip wood, mounted in or-molu, containing beautiful panels in porcelain. M. A. E. Ringuet-Leprince introduced carvings of ivory, mounted with or-molu, on one of his cabinets, with excellent effect; and in his most beautiful ebony cabinet for medals, relieved with exquisite carvings, fine stones were inlaid so as to form part of its decoration. Many of the pieces of furniture owed much of their attraction to the metal ornaments with which they were mounted; but the ebony cabinet of M. Barbedienne combined, in the very element of its construction, bronze ornaments and figures, of a high class of art, so arranged as to form one united whole.

Of the carved furniture in the exhibition we have already given ample description: we shall therefore pass over to another branch of cabinet-work, which merits particular notice—that in which mechanical action is introduced; the specimens exhibited by MM. Daubet and Daumaret, of Lyons, were most ingenious and curious; in their secretaire, which was full of contrivances, one key unlocks all the drawers. These run in the most easy and perfect manner, if touched in the slightest degree; and the closing of one particular drawer shuts and fastens all the others. M. Krieger, of Paris, also exhibited some fur-

niture of excellent mechanical action, such as card-tables, toilets, &c.; and M. Von Hagen, of Erfurt, had a cabinet of fine workmanship, in which the secret mechanism was skilfully carried out. In the Austrian collection were some curious chairs and furniture, by M. Thouet, of Vienna, in which the wood, inlaid with metal lines, was bent to the required forms, without the usual framing. Many excellent billiard-tables were exhibited: in one, by M. Bouhardet, of Paris, the carving was of very beautiful design; another, by M. Knill, of Vienna, was handsomely mounted in buhl inlay; and the inlaid cues of this manufacturer were very beautiful specimens. The billiard tables of Messrs. Thurston, and of Messrs. Burroughs and Watts, of London, were of simpler construction, but solid, and of excellent workmanship.

Decorations.—The specimens exhibited under this head were decorations for walls and ceilings, imitations of woods and marbles, and painted blinds. Several of the ceilings under the galleries of the exhibition building were decorated with more or less taste, principally in the Arabesque style. One, painted by Signor Montanari, of Milan, in one of the Austrian departments, deserved particular notice: it was a carved ceiling, executed with great breadth of effect. The imitation of gold was excellent, and the general treatment was full of spirit and force. In wall decoration Mr. Morant exhibited a handsome panel, mounted with gilt ornaments and mouldings; the latter upon a ground of looking-glass. In the centre of the panel was painted a figure, surrounded by foliage Arabesque. Mr. Moxon's panelling, over a chimney-piece by Mr. Thomas, in the English furniture court, was a tasteful specimen of decoration; and the imitations of woods and marbles, by this gentleman, were executed in a very superior manner, united with an ornamental character of a high class. Messrs. Holland, of Warwick, exhibited table-tops in imitation of marbles, ornamentally arranged in the old Italian style, with good effect. Mr. Kershaw's imitations of woods were also very excellent; and those by

Messrs. Nicoll and Allen, of wood and marble, had also considerable merit. Some of these imitations of wood were painted on glass, the polished surface of which gave great finish to the work. Among the painted blinds, those by M. Bach Peres, of Paris, were considered good specimens. The wax-cloth hangings, by M. Vivet, of Paris, were painted ornamentally in the style of Francis I., and were stated to be so prepared as to resist the effects of moisture.

Paper-hangings.—Paper-hangings form a manufacture of considerable importance, carried on in most of the principal cities of Europe, employing many artists and designers, and thousands of operatives; consuming also vast quantities of paper, colours, wool, and metal. They are important, also, because they may be made the means of extensively diffusing taste for art; and, from the low price of the cheaper kinds, enabling the humblest mechanic to give to his home an air of elegance and comfort. It is difficult to determine the period when paper-hangings were invented. They are supposed to have been first made in China; and the introduction of these hangings into Europe probably suggested the manufacture here. They may be divided into three kinds—the flock, the metal, and the coloured; and each of these seems to have been invented at a different time, as an imitation of a distinct material. The flock, to imitate the figured tapestries and stuffs; the metal, in imitation of the gilt leather hangings; and the coloured, as a substitute for painted decoration. It is generally allowed that flock hangings were first manufactured in England, and invented by Jerome Lanyer, who obtained a patent in the reign of King Charles I., dated May, 1634, and carried on his art in London. In this patent it is stated "that, by his endeavours, he hath found out an art and mystery of affixing wool, silk, and other materials, of divers colours, upon cloth, silk, cotton, leather, and other substances, with oil, size, and other cements, to make them useful for hangings and other occasions, which he calleth Londriniana; and that the said art is of his own invention."

M. Savary, in his *Dictionary of Commerce*, 1720, says that tonture-de-laine, or flock-hangings, were first made at Rouen, but in a coarse manner, being only used for grounds, on which, with flocks of different kinds, were formed designs of brocades. They essayed to imitate tapestry-hanging, but not successfully; and a last a manufactory was established at Paris, in the Faubourg St. Antoine, and there flowers and grotesques were introduced with success. The manufacture is thus described by him:—"The artist having prepared his design, drew on the cloth with a fat oil or varnish the subject intended to be represented; and then the flocker, from a tray containing the different tints of flocks, arranged in divisions, took the colours he required, and sprinkled them in a peculiar manner with his finger and thumb, so that the various shades and colours were properly blended, and an imitation of the wove tapestry produced." These descriptions, though detailing the manufacture of flock-hangings, yet do not allude to the use of paper as a ground, nor to blocks for printing. A French author, writing in 1723, says that paper-hangings, called tapestry in paper, were, till lately, only employed by the country people for their cottages, or by small tradesmen in their shops and rooms; but towards the end of the seventeenth century, the manufacture was raised to such a point of perfection and beauty, that besides the quantities that were exported abroad, and to the principal cities of the kingdom, there was scarcely a house in Paris not decorated with it. The manufacture at that time is thus described:—"The design, having been drawn in outline on paper, pasted together, of the size required, was then divided into parts of a suitable form, and given to the carver or wood-engraver, to cut the design on blocks of pear-tree, much in the same manner as at present. The outline thus cut was printed in ink, with a press, on separate sheets of paper: when dry, these were painted by hand in distemper colours, and afterwards joined together, so as to form the required design. Grotesques and panels, in which were intermingled flowers,

fruits, animals, and small figures, were then executed by the above process." M. Reveillon, of Paris, is considered to have introduced many improvements in this manufacture, and was celebrated for the beauty of his productions in the latter end of the last century. The pillage of the workshops of this manufacturer in the Faubourg St. Antoine was one of the first incidents of the revolution in 1789.

In England this manufacture continued from the time of Lanyer, and obtained a high reputation. In 1712, a duty of $1\frac{3}{4}d.$ per square yard was imposed; and a Mr. Jackson, who established a factory at Battersea, for paper-hangings of classic design in chiaro-'scuro, writes, in a work published in 1754, in praise of his own productions, and condemns the fanciful paper-hangings at that time so much used, comparing them with the Chinese. In the year 1786, there was established at Chelsea a manufactory for paper-hangings of a very superior description, by George and Frederick Echardts. Works excelling even those of the present day were produced at this place; some of the blocks used are at present in possession of the writer of this report: they have great merit in the designs, and are some of them eight feet in length. These manufacturers carried the art to its highest point in England; they printed not only on paper, but also on silk and linen, and employed a number of artists, in addition to workmen and children. Mr. Sheringham, of London, also excelled at that time in decorative paper-hangings. During the present century, the French have not only restored this branch of manufacture to a high state of perfection, but have also introduced many important improvements, such as the embossed flocks and the shading of flocks, the perfect imitation of chintz, improvements in the satin-grounds, and the introduction of work printed from engraved cylinders.

In England, the trade was protected by a duty of 1*s.* per square yard, up to the year 1846, when sir Robert Peel reduced it to 2*d.* This high duty acted almost as an

exclusion to foreign makers, and there was therefore no competition with them, nor any inducement to improve. Since that time, however, the English manufacturers have made great progress in their art, both in style and workmanship, the trade has greatly increased, and the improved productions are sold at a greatly reduced price. They have, besides, applied themselves to the improved application of machinery, by which very beautiful papers are made at an extremely cheap rate.

The process of manufacturing ordinary paper-hangings, as now carried on, may be thus briefly described:—"The pattern being first carefully drawn, is then pricked, and the outlines of the various tints are pounced each on a separate wood block made of pear-tree, mounted on pine. These blocks are pressed on the sieves of colour, and then applied to the paper, each block following the other on the guide marks left by the previous impression. An idea may be formed of the enterprise and labour required to produce some of the decorative paper-hangings for the Great Exhibition, by stating that more than twelve thousand have been employed on a single one of them. In making flock-paper, the pattern is first printed in size, and then with a preparation of varnish or japan gold size. When this is partly dry, coloured flock, prepared from wools, is sifted on the varnish pattern, to which it adheres. Great improvements have been made of late years in this manipulation, more especially by French manufactures. Paper-hangings, where gilding is introduced, are prepared much in the same way as for flock: the leaf-metal is laid on the varnish pattern, or, if worked in bronze powder, it is brushed over with a hare's foot. The English manufacturers have attained great perfection in the preparation of metal-papers. The gilding having to encounter the damp and variable climate, is most severely tested; but by means of good material, careful manipulation, and a preparation washed over it, it remains unchanged for a considerable period."

Paper-hangings have been printed in England by means

of hand-machines for many years, the papers being made in lengths of twelve yards, or single pieces, in one or two colours, and these colours falling separately on the ground. It was not until about ten years since, what is now understood as machine-printing was fully introduced; and this was done by Messrs. Potter, of Darwen, who, by means of steam-power, artificial drying, and an endless roll of paper, were enabled to produce patterns with good effect, by surface-roller-printing in several colours, on the principle of calico-printing: specimens showing fourteen colours were exhibited by this house. Messrs. Heywood, Higginbottom, and Co., of Manchester, have also effected great improvements in the manufacture, and exhibited patterns showing twenty colours made by fourteen rollers; and Messrs. J. Woollams and Co., of London, likewise exhibited excellent specimens made by machinery, in addition to those they make by block-printing. These machines are now each capable of printing from one thousand to one thousand five hundred pieces per day; and, although the work is not equal to block-printing in the solidity or permanence of the colours, yet the small price at which it is produced commands an extensive sale, superseding, to a great extent, the cheaper kinds made by hand. The above remarks apply only to paper-hangings of the cheaper qualities, for machine-printing has not yet been successfully applied to those with glazed or satin grounds. There is also another evil which it is most desirable to remedy—the colours are liable to run, without great care, in the hanging.

There were very beautiful specimens of paper-hangings in the Great Exhibition; works which not only possessed considerable artistic excellence, but also showed great progress in the manufacture.

France has justly acquired a high renown for her works in this branch of industry. M. Delicourt, of Paris, exhibited a tapestry-like picture, entirely printed by blocks, representing a chase in a forest, surrounded by a rich, ornamental frame, with pilasters containing animals,

birds, and attributes of the chase: twelve thousand blocks were required to execute this most creditable work. He likewise exhibited flower decorations, entirely executed in flocks, of which there were about seventy different shades; also very beautifully-finished plain flock-papers, called silk and wool. His two bas-reliefs of *The Descent from the Cross*, and *The Resurrection*, were good specimens of printing. M. Zuber, of Rixheim, exhibited one of his beautifully-executed landscape papers—one of a series of works for which this house is so celebrated; it represented the floral vegetation of the four quarters of the globe, and the richness and brilliancy of the colouring and the perfect workmanship were alike remarkable. M. Zuber also exhibited many other excellent specimens of the various kinds of paper-hangings, &c.: he is, besides, the author of many improvements in this trade. Messrs. Mader, of Paris, exhibited a picture representing a garden-scene—a very clever example of paper-printing, left, perhaps purposely, in a state where a few touches, by the hand of a clever artist would complete a beautiful effect. A well-executed figure in a panel, and other decorations of flowers and ornaments, besides some specimens of the more ordinary kinds of paper-hangings, attested the skilful workmanship of this house.

The English manufacturers of paper-hangings have produced many beautiful specimens also, both as decorative, damask, chintz, and flock-papers; those made by machinery have been previously alluded to. Messrs. Townsend and Parker, of London, exhibited paper-hangings of various kinds, of considerable beauty of design and execution; two of their decorations introduced fruit, flowers, and arabesque ornament of excellent execution. Messrs. Hinchliff and Co., of London, also produced good specimens of decorative and other paper-hangings; and the collections of Messrs. Williams and Co., and Messrs. Turner and Co., included many examples, showing that the art is well carried on in this country. Messrs. Spörtin and Zimmermann, of Vienna, exhibited paper-hanging

decorations for ceilings, &c., in good taste. They have also adapted the process of block-printing in distemper colours, as a cheap form of illustrating works of science and art; the specimens they exhibited gave illustrations of machinery in isometrical perspective, very beautifully executed. M. Devis, of Brussels, exhibited a large collection of paper-hangings, more particularly in flock, of excellent execution. M. M. Rahn and Vetter, of Warsaw, forwarded a collection of paper-hangings, which possessed considerable merit, both as regards design, colouring, and execution.

CHAPTER XXII.

DIGBY WYATT, ESQ., ON FORM IN THE DECORATIVE ARTS.

PRELIMINARY REMARKS—INFINITE VARIETY OF NATURE—FITNESS AND SIMPLICITY — CONTRAST — CONSIDERATIONS ON ARCHITECTURE AND SCULPTURE—OPTICAL DELUSIONS—IMITATION—ORNAMENT, ETC.

"It has pleased the beneficent designer of 'the world, and all that therein is,'" says our accomplished lecturer, "not only to surround man with the ever-varying and inexhaustible beauties of nature, and to endow him with the gift of sight to perceive her graces; but he has been pleased also to confer upon him a mind to understand, and a hand to imitate them. These gifts are clearly talents committed to our charge, and to be accounted for by us. The same power—

> 'That gave us in this dark estate
> To know the good from ill,'

conferred upon us also an unerring natural test to distinguish the beautiful from the mean or ugly. That test

is the sensation of delight which invariably accompanies our recognition of beauty, moral or physical. Whenever the powers of the mind are concentrated upon any of the great external evidences of Omnipotence—upon 'the heavens above, or on the earth beneath, or on the waters which are under the earth'—it is impossible to refrain from pouring forth a tribute of silent but heartfelt admiration; and at such moments the Creator, as if to mark his approbation of the sacrifice, lulls for a while all memory of earthly pain or care, and pours peace and happiness into the soul. Thus it is that 'a thing of beauty is a joy for ever.' It is impossible to examine the smallest object upon which the skill of divinity has been exercised—a shell, a flower, or an insect—without feeling a longing to know somewhat of the mysterious laws which make that individual specimen of design so perfect, and without experiencing a desire to emulate the marvellous powers of creation. The first sensation of the exercise of such powers we feel to be godlike. Thus it is that man naturally attempts, in his feeble way, to emulate the loftier faculties of divinity; and thus ''tis to create, and in creating live a being more intense, that we endow with form our fancy." From such exertions spring all that is ideal or poetical in every art.

"Whenever we attempt to penetrate the wondrous system that makes all nature one vast harmony it is impossible to refrain from feeling that—

> 'God moves in a mysterious way
> His wonders to perform;'

and that it is as yet our portion only to see the full light of his majesty as 'through a glass darkly.' Enough, however, is still apparent to teach us that there are conditions of harmonious relation which pervade the most exquisite forms in divine creation; and it is only while catching a faint reflection from their glories that we can hope to succeed in the slightest degree, in throwing a veil of beauty over our comparatively insignificant productions.

The first operation indispensable to any attempt to define the principles which should determine form in decorative art, must obviously be an investigation into those conditions of divine design in concord with which all human attempts at its imitation must be moulded, before a supreme sensation of delight can be produced. The occurrence of such a sensation we have already pointed out as the constant and unerring test of real beauty. We purpose, therefore, in the first place, to draw such general inferences together, concerning the great scheme of design manifested in the noblest works of nature, as we have been enabled to collect, either from the experiences of others, or our own study of the subject. The second operation must evidently be, to trace the application of these general inferences to the various material branches into which the different necessities of man, or his sympathies, have divided all those decorative arts which minister to his cravings for enjoyment on all occasions. We purpose, therefore, in the second place, to take a rapid survey of the principal members of that great family, and to point out some of the innumerable enactments of nature, specially affecting several of the most important individual 'departments of practical art.' Never in the whole history of the past has such a body of appropriate illustration of this branch of our subject been collected as was brought together in the vast extent of the ever-memorable Palace of Industry; and it was impossible to examine carefully the rich store of material enclosed within its glassy walls, without gathering some few valuable hints.

"In entering on the first division of our, perhaps, too ambitious attempt, we are overcome with a sense of the infinite minuteness of our knowledge of the great conditions of creation. We recognise an almost universal beauty throughout the works of nature by the exercise of some faculty, as intuitive as memory, and not less inexplicable when we essay to predicate concerning its ineffably mysterious constitution. It has been well observed by

some metaphysical writers, that in the development of the intellectual powers, the first effort is to realise, the second to enjoy, and the third to reason. In obedience to this theory, the first and constant effort of every child is to feel, to see, to use its senses, and to verify the fact of its existence by ascertaining its physical relation to all by which it is surrounded. Its second and occasional effort is to eat, to drink, to smell, to show pain and pleasure, likes and dislikes, and to observe and treasure up such experiences as can affect its subsequent enjoyment. The third effort is to exercise the gift of thought, and to form conclusions by other processes than those of direct sensation. Now we, as respects our knowledge of divine beauty, can be regarded only as very little children; and, if we would improve upon our condition of ignorance, instinct leads us onwards through parallel states of progress. Let but the first effort of one totally uneducated in art be to see and to feel nature, to look upon her works with an observant eye, and he will almost instantly find himself led on by unerring sensations of delight to the second stage of advancement. In that stage he will enjoy, discriminate, select, store in his memory, and at length endeavour either to reproduce, or cause to be reproduced, those natural objects, contact with which has caused him the greatest amount of pleasure. Thus the first phase of all art is rude direct imitation. No sooner does he arrive at the full development of his secondary condition, than he passes into the third. He begins to speculate upon the sensations he experiences, upon the phenomena of recurrence, and on the means whereby he may be enabled, by his own description or imitations of the original types, to convey to others the pleasures he himself derived from a contemplation of them—thus the ignorant may grow into the connoisseur, and thus the child into the artist.

"A knowledge of the sequence of these natural phases of transition points out the course by which alone special education in decorative art can be brought to a successful

issue. Surround the pupil with every attainable example of general beauty of form, if he is to be a general artist or draughtsman; make him acquainted with all the antecedent productions in his speciality, if he is to be a special designer. Show him only as much as possible of what is good, whether general or special; then his sense of enjoyment will teach him selection, and he will store his memory with the best. Practise his hand as you educate his senses, and the feeling of power will soon come upon him. Reason will assert its empire, and inquiry will be stimulated. Once roused, effort will succeed effort, and thus in time the pupil will grow into the master. As it is impossible to arrive at correct theories in science, except by the analysis of accumulated observations—firstly, of things; secondly, of properties; and thirdly, of relations—so it is impossible to assume any general conclusions concerning divine design without passing through the three stages of realization, enjoyment, and reflection. When we take into consideration, on the one hand, the shortness of life and the limitation of the powers of man, and on the other, the extent and illimitable divisibility of matter and its incessant changes in form and application, we cannot but feel conscious in how slight a degree the best disposed and most talented student of nature can have become acquainted with her innumerable phenomena, a thorough knowledge and enjoyment of which we have shown to be indispensable to any just general conclusions. It is only by the transmission from generation to generation of accumulating experiences and deductions, that the very few points we are about to indicate have been assumed as universal recurrences in the external forms in which nature pours forth her bounteous gifts to man.

"The first quality with which the observer must be struck is the infinite variety of form which pervades creation. On attempting to reason concerning it, he perceives its dependence upon the functions each object, and the component parts of each object, are ordained to fulfil; hence he will at once recognise the fact, that

form is in every case, if not dependent on, at least coincident with, structural fitness. When the most complex flower is submitted to the test of a scientific botanical examination, no particles are found to be adventitious—all are concerned in fulfilling the appointed functions of vegetable physiology. As those functions vary with the growth of the plant, so in every case does its form—changing from tender bud to blooming flower, and from blooming flower to reproductive seed-pod, as each successive change of purpose progresses. Infinite variety and unerring fitness thus appear to govern all form in nature. While the former of these properties demonstrates her infinite power of complexity, the latter restrains the former, and binds all in beautiful simplicity. In every case ornament appears the offspring of necessity alone; and, wherever structural necessity permits, the simplest lines, in every case consistent with the variety of uses of the object, are adopted. Thus, the principal forest-trees, which spring erect and hardy from the ground, in their normal state, uninfluenced by special conditions of light or heat, shoot straight aloft, with boughs equally balanced on all sides, growing so symmetrically, that a regular cone or oviform would, in most cases, precisely define their outline; and thus the climbing plants, from their first appearance, creep along the ground in weak and wayward lines, until they reach something stronger and more erect than themselves; to this they cling, and from it hang either vertically or in the most graceful festoons; to each its character of form as of purpose—to each the simplest line consistent with its appointed function and propriety of expression. From nature's delight in simplicity, man probably derived his earliest perception of geometrical figures. The term horizontal at once betrays the source from which our idea of such a line may have been derived. Upon the horizon, as a base, endless perpendiculars are erected in every plant that pierces the soil at right angles to its tangent. A plain in nature furnishes the idea of a plane in geometry. Every variety of triangle is indicated

by the outline of the snow-clad peaks of the loftiest mountains; every kind of cone by their substance. The thin clouds that sweep along the sky at sunset, hanging over the distant blue line of the ocean, form exquisite parallels; and where cut by the lines of trees and plants suggest every variety of square and oblong, rhombus and parallelogram. Where compactness is indispensable, the honey-yielding hexagons abound; and in her endless variety of crystals, nature has furnished us with models of the most exquisite solids. In the rainbow we have her noblest arch; in the parabola at once one of her most graceful curves and most elegant formulæ of projection.

"While a consideration of the quality of fitness binds us to simplicity, that of variety, as if in counterbalance, conducts us to a just recognition of the value of contrast throughout all the works of creation. Simplicity becomes appreciable only when opposed to complexity; while complexity itself will, on analysis, be found to consist only of the combination of parts, individually of extreme simplicity. The researches of Mr. Penrose have lately developed many of the most interesting phenomena respecting the 'simultaneous contrast of form;' and have not only demonstrated the fact of the scientific acquaintance of the Greeks with their peculiarities, but have shown how essential an attempt to apply such knowledge has been to the production of those exquisite monuments which, from the first moment of their creation to the present time, have maintained a position of unquestionable supremacy over every other work which human art has yet produced. The general result of Mr. Penrose's investigation tends to the assumption, that no two lines can come in contrast with one another, either in nature or in art, without the direction of the one acting, either attractively or repulsively, upon the other, and tending to diminish or exaggerate the mutual divergence of both lines, *i. e.* to increase or lessen to the eye the angle at which they meet. Thus, if to a perfectly horizontal line another be drawn, meeting it at an angle of six degrees (about half the angle

at which the inclined sides of the best Greek pediments leave the surface of the cornice), it will be difficult to convince the eye, as it traces the direction of each line, that the angle has not been materially increased by an apparent deflection of the base line, and an apparent very slight drawing down of that with which it actually forms an angle of six degrees only. In order to remedy similar apparent distortions in their monuments, the Greeks have given Entasis, or swelling to their columns, inclination of the axes of their pillars towards a central line, a tendency outwards to their antæ, and exquisite convex curves to the horizontal lines of their cornices and stylobates, which would otherwise have appeared bent and crooked. Nature, in working out her harmonies of contrast, abounds with similar optical corrections. The infinitely gentle convexity of her water sky-line is precisely corrected into perfect apparent horizontality by contrast with any line at right angles to a tangent to its curve. It is by attention to the optical effects produced by the impact of lines upon one another in nature, that the artist can alone store his mind with the most graceful varieties of delicate contrast. Thus it is alone that he can appreciate the extreme beauty of her constant, minute, and generally inappreciable divergence from the precise mathematical figures, in approximation to which simplicity demands, as we have already shown, that her leading forms should be modelled.

"We have now arrived at a recognition of the four principal elements which invariably concur in producing those emotions of delight, which may be regarded as infallible tests of our contact with real beauty in the productions of nature—variety, fitness, simplicity, and contrast. Before leaving our consideration of these elements, we cannot refrain from drawing attention to that which is the crowning illustration of the effects of their co-operation—the human body; that theme, upon the re-production of the external features of which the highest powers and the profoundest study have been lavished by the greatest artists of all time. In its structure, the anatomist, aided by

microscopic examination, discovers a *variety*, to which that of the Great Exhibition was monotony itself; a *fitness*, to which the most exquisite machines therein contained displayed no parallel; a *simplicity* of external form, which, without the slightest display of all that marvellous internal mechanism, confines the whole in a space precisely adapted for the free working and protection of every part, and yet covers all with a soft and undulating surface, the curves of which are gentleness and *simplicity* itself. *Contrast* between curve and curve, between one line of limb and another, produces in motion incessant *variety* of expression, still in obedience to the bounding conditions of simplicity. The swelling muscles, increasing as the angles of approach are diminished by their action, counteract otherwise apparently ungraceful concavities, and in that loveliest of created things, the perfect female form, every quality of beauty is freely and exquisitely balanced and united.

"To recapitulate the sequence of these four great impressions, we may state, that when the attention of the student of nature is first concentrated earnestly upon her works, his senses are bewildered by the variety of her charms. His first discovery will probably be that of the perfect individual fitness of some one object upon which he may fix for analysis; he will subsequently recognise fitness as universal. In perfect fitness he will marvel at perfect simplicity; and as he becomes acquainted with normal forms, isolated or at rest, he will learn to gather general impressions when he witnesses their combination, or varying forms in contrasted action. As from this point his experiences increase, he will begin to appreciate marvellous affinities; he will find certain conditions universally forming the basis of propriety in all imitations of nature. Thus he will recognise that she has a style of form and detail peculiar and appropriate to every material in which she works, and that this style of form and detail is, in every case, modified by the exact method in which her operations of manufacture are conducted. Of this no more perfect

illustration can be given than the lines of fibrous reticulation which constitute the substance, and at the same time form the ornament, of every leaf that blows. In the aggregate of every class he will trace general character, while the slightest variety of structure will infallibly be testified by some change in external outline. Gradually form will become with him an index to all leading attributes; a clue by which he will at once recognise the relation of bodies, or their properties, to one another. Thus, from form alone he will soon discern at a glance of what materials, and how, any particular object he may examine has been executed. This index or clue, be it remarked, never misleads; the 'lamp of truth' never in nature burns dimly, nor with fallacious fires; never refuses to illuminate those who incline to learn in a truthful and reverential spirit. One material in her productions never looks like another. Rocks have their rugged outlines; minerals their appropriate crystal; metals their colours and glittering aspects; timber its bark and cellular section; flowers their delicacy and evident fragility; even transparent bodies their varying angles of refraction; water its glassy surface when at rest, and unmistakeable curves when agitated. Never does a flower look like a piece of metal; never a piece of timber like a rock.

"As the student's acquaintance with these consistencies in nature increases, his power of generalizing will become developed. He will learn to separate constants from accidents, and to trace the distinctive lines which convey the idea of each general family of materials, or modes of formation. He will begin to select, and to treasure up in his memory, those symbols of expression with which nature indicates the leading characteristics of every variety of object she produces. On the amount of the artist's acquaintance with such conventionalities, or, in other words, with the written language of nature, will entirely depend his possible success in producing by his labours sensations of delight at all equivalent to those excited by the aspect of her noblest works. Direct imitation will do next to

nothing; fanciful and ignorant invention still less: it is alone by his power of wielding her weapons of expression, and making in all cases the form and the object strictly concordant, as she does, that the artist may aspire to emulate the power of giving delight, which, above all others, appears to be her paramount prerogative. Time will not permit our dwelling further upon the general inferences deducible from a study of the wonderful beauties of nature. Enough may, however, have been enunciated concerning the most palpable principles, to warrant our assertion, that there exist conditions of harmonious relation which pervade the most exquisite forms in divine creation. It will be our pleasing task now to show, how essential it is that we should catch a faint reflection from their glories, before we can hope to succeed in the slightest degree in throwing a veil of beauty over our comparatively insignificant productions.

"In entering on the second division of our subject, we shall endeavour to trace the application of principles analogous to those on which we have lately dwelt—in the first place, generally; and in the second, to the respective leading and special departments of practical art. In the first place, then, it may be observed generally, that the endless diversity of men's tastes, and the ever-changing conditions of their education and association of ideas, demand for their productions a *variety* almost as incessant as that which pervades creation. Whenever that craving after variety has been gratified, irrespective of *fitness*, novelty has degenerated into frivolity, design into conceits, and style into mannerism and vulgarity. Without a due attention to *simplicity*, fitness has never been adequately carried out; attention has been diverted from a proper estimate of every work of art or object of manufacture; and false impressions concerning its true and legitimate functions have been generated.

"Contrast teaches us to give a due relief to all to which we would desire to call attention. A sudden break in a long straight line, a slender necking in a continuous sweep,

a sudden concavity in a generally convex outline, a bold projection starting forward from an even plane, right lines opposed to curves, segments to sections of the cone, smooth to rough surfaces, conventional forms to direct imitations of nature, all carry out the desired object, and are every one subject to the phenomena of simultaneous contrast of form. To obviate such optical delusions, allowances must be made in every case by the artist; many such corrections are constantly perceived and effected by the eye; but few, alas! by rule. In reference to such corrections, it is justly remarked by so ancient a writer as Vitruvius, that 'the deception to which the sight is liable should be counteracted by means suggested by the faculty of reasoning. Since the eye alone,' he continues, 'is the judge of beauty, and where a false impression is made upon it, through the natural defects of vision, we must correct the apparent want of harmony in the whole by instituting peculiar proportions in particular parts.'

"When we turn to a consideration of the united action upon human design of the general principles of consistency, exhibited in the works of nature, we find that of all qualities which can be expressed by the objects upon which our executive ability may be occupied, the noblest, and most universally to be aimed at, is plain and manly truth. Let it ever be borne in mind that design is but a variety of speech or writing. By means of design we inscribe, or ought to inscribe, upon every object of which we determine the form, all essential particulars concerning its material, its method of construction, and its uses; by varying ornaments, and by peculiar styles of conventional treatment, we know that we shall excite certain trains of thought and certain associations of idea. The highest property of design is, that it speaks the universal language of nature, which all can read. If, therefore, men be found to systematically deceive; by too direct an imitation of nature, pretending to be nature; by using one material in the peculiar style of conventionality universally recognised as incident to another; by borrowing ornaments

expressive of lofty associations, and applying them to mean objects; by hiding the structural purpose of the article, and sanctioning, by a borrowed form, the presumption that it may have been made for a totally different object, or in a perfectly different way—such men cannot clear themselves from the charge of degrading art by systematic misrepresentation, as they would lower human nature by writing or speaking a falsehood. Unfortunately, temptations to such perversions of truth surround the growing designer. The debilitating effects of nearly a century's incessant copying without discrimination, appropriating without compunction, and falsifying without blushing, still bind our powers in a vicious circle, from which we have hardly yet strength to burst the spell. Some extraordinary stimulant could alone awaken all our energies, and that stimulant came—it may not, perhaps, be impious to esteem providentially—in the form of the great and glorious Exhibition. It was but natural that we should be startled when we found that in consistency of design in industrial art, those we had been too apt to regard as almost savages were infinitely our superiors. Men's minds are now earnestly directed to the subject of restoring to symmetry all that had fallen into disorder. The conventionalities of form peculiar to every class of object, to every kind of material, to every process of manufacture, are now beginning to be ardently studied; and, instead of that vague system of instruction by which pupils were taught, that anything that was pretty in one shape was equally pretty in another, a more correct recognition of the claims of the various branches of special design, and the necessity of a far closer identification of the artist with the manufacturer, in point of technical knowledge, have been gradually stealing upwards in public estimation. Let us hope that success will crown exertion, and that in time the system of design universally adopted in this country will offer a happy coincidence with those lofty principles by means of which the seals of truth and beauty are stamped on every emanation from the creative skill of divinity.

"In approaching the more directly, though not essentially, practical portion of our subject—that of the application of nature's principles to some of the special departments of practical art, represented in the Exhibition, we shall premise by a few considerations on architecture and sculpture, and the plastic arts. It would be difficult to imagine a juster and more comprehensive view of the extent of direct imitation admissible in each department of the fine arts than that which was presented in the *Appendix to the Third Report of the Commissioners*, by Sir Charles Lock Eastlake. In a note to one of those important essays the writer observes, that 'the *general* style of the formative arts is the result of a principle of selection, as opposed to indiscriminate imitation. It consists, therefore, in qualities which may be said to distinguish those arts from nature. The specific style of any one of the arts consists in the effective use of those particular means of imitation which distinguish it from other arts. Style is complete when the spectator is not reminded of any want which another art, or which nature, could supply.'

"Now, the specific style of architecture is especially worthy of study; since, not only do similar conditions pervade all branches of design into which structural forms enter as principal elements, but of all the arts it is obviously the least imitative, and the most abstract. The effects of delight which can be produced by it, are dependent, not upon a reproduction of any objects existing in creation, but upon a just display by the architect of his knowledge of those subtle general conditions, a few of which we have recognised as pervading every perfect work of nature. The beauty of civil architecture, we are told by the best writers upon the subject, depends upon—1st. Convenience; 2nd. Symmetry, or proportion; 3rd. Eurythmia, or such a balance and disposition of parts as evidences design and order; and, 4thly, On ornament. In too many modern buildings, alas! we find that either convenience has been attended to and all other qualities left to chance, or, what is still worse, ornament alone aimed at,

and all other considerations disregarded. Let us, for the sake of example, trace the operation of the principles to which we have alluded, all of which will be found to have their origin in the provisions of nature. The wise architect will begin by considering the purpose of his building; and will so contrive its plan and leading form, as to fulfil all the utilitarian objects for which it was proposed to be constructed; in other words, he will be governed by a sense of *convenience* or *fitness*.

"He will then consider how all the requisites can be most agreeably provided, and harmonious proportion combined with an expression of purpose. He will find, on recurring to nature, that every substance suitable to be employed in construction, exhibits endless *variety* in strength, weight, and texture. He will study these various qualities, and by experiment ascertain that each material possesses a certain scale of proportions, and a certain series of solids, by the employment of which, in fixed positions, its functions may be at once most economically and most fitly employed. Acting on such data, he will distribute his lines of sub-structure, his columns of support—his load supported, his walls to resist the driving of the elements; and he will assign to each its special proportion and form—never confounding those of one substance with another—never using iron as he would stone, or wood as glass should be. Thus aided by his sense of the functions of each portion of the structure, the material of which it may be constructed, and its condition of relative importance, the architect adjusts the appropriate dimension of every part. His work is as yet, however, only half done; his materials require bringing into graceful and regulated distribution. At this point, Eurythmia, the original of 'the fairy order,' steps in, bringing geometry in her train. Doors, windows, columns, cornices, string-courses, roofs, and chimneys, are instantly disposed so as to contrast with, and balance one another, showing, by the symmetry of their arrangements, the artist's appreciation of that method and evidence of design which indicate the re-

straining power of mind over matter throughout all nature—wild as her graces may occasionally appear. The crowning difficulty yet remains behind in the adjustment of appropriate ornament. In all other departments of his art, the architect employs only pure abstractions, harmonizing with his general deductions of leading principles of beauty: in his application of ornament, however, his resources are somewhat more expanded. All decoration, the forms of which are borrowed from nature, to be pleasing, must undergo a process of conventionalizing; direct imitation, such as that which would be produced by casting from a gelatine mould, would infallibly disappoint, since the perfect reproduction of the form would lead to demands for reality—in colour, in texture, and in other qualities which it might be utterly beyond the power of any other material or processes to render, than those which nature has herself employed in the original. The duty of the architect is, therefore, to study, first of all, to employ such forms as harmonize and contrast with his leading lines of structure; and then, in those few instances where, for the sake of adding more immediately human interest to his work, or for explaining its purpose more directly, he may desire to suggest the idea of some object existent in nature—then, and in such a case, it is his duty to symbolize rather than to express, and to strive to convey an idea of particulars and qualities only, instead of to make a necessarily imperfect reproduction, which conveys no idea at all.

"As a general rule, the less closely the artist attempts to embody nature the more safe he will be, but as there are, we conceive, some few cases which justify a nearer approximation than is generally admissible, we shall proceed to enumerate the most important of them, premising that, paramount over every other consideration, must reign an exact regard to the conventionalities incident to the material employed, and the absolute necessity of arranging the forms of the ornament, so as to contrast rightly with the adjacent geometrical lines of structure.

"1st. That imitation may approximate to nature only in an inverse ratio to the resemblance of the material in which the work is to be executed to the object to be copied. Thus, the smoothness of flesh may be imitated with delicacy in white marble, and the idea of rock-work only conveyed in the same material by a completely formal and geometrical method of representation.

"2nd. That as imitation, in all cases, interests and attracts attention, it becomes necessary to restrict its use sparingly to particular situations; thus, we may, on the one hand, with propriety employ decorations suggestive of natural types, in those few important points on which we wish the eye to dwell, such as the centre of a façade, the principal doorway, or window, the starting of a staircase, or the end of a boudoir; but if, on the other hand, we employed in such leading situations mere conventional patterns, and in less important parts, ornaments in convention approaching imitation, then we should find attention concentrated on those meaner portions of the structure, and the really principal features of the design passed over and neglected. A striking illustration of the consequences of this want of discrimination was shown by the sculptor Lequesne, in his various groups in the great Exhibition; the care he bestowed in working up his accessories, his weeds, foliage, rocks, earth, and everything else, almost entirely neutralized the interest which should have been excited by the finished treatment of the flesh of the unhappy mother and her miserable infant. The admiration which might otherwise have been given to his two groups of dogs and boys, were completely absorbed by admiration at the patience with which 'each particular hair' was made to curl. To all the above-described faults the works of M. Etex offered a truly remarkable contrast, the labour in them being applied at exactly the right points.

"3rdly. That, where ornament is contrasted by evident connexion with geometrical lines of structure, conventional

imitation may be introduced. Thus, in many of the marble chimney-pieces in the Exhibition, and in much of the furniture, the structural forms of which made regular panels, or conventional frame-work, the introduction of nicely-carved flowers or fruit, of the size of nature, and in low relief, produced an agreeable effect. Where, in others (and more particularly in some of the Austrian), the foliage, scrolls, cupids, and all sorts of things, completely ate up the whole surface, and made up the whole structure, the effect was eminently objectionable.

"4thly. That where the copy differs absolutely in bulk from the original, minutiæ of surface detail may be introduced. Thus, when we reduce a subject, such as a bunch of grapes, from the round or full relief to the lowest relievo, much of the conventionality which would otherwise be essential may be dispensed with.

"5thly. That considerable differences of scale in things of unvarying dimension, justify an approach to natural form. Thus, when we materially diminish in our reproduction any object, the smallest size of which is generally known never to equal that to which it is lowered in our copy, we may safely attempt as close a conventional transcript as the material in which we work admits of. On this account delicate flowers, such as those which decorate small Dresden china vases, and which are executed with such skill in biscuit by Mr. Alderman Copeland, Mr. Minton, Mr. Grainger of Worcester, and others, form not unappropriate ornaments when confined to a scale considerably smaller than nature. In cases, however, such as that of the Dresden white camellia tree of the Exhibition, where an attempt is made to copy nature on her own scale, the effort altogether fails, and the labour, so far from giving pleasure, is utterly useless and becomes a trick not less inimical to good taste than the veiled figures.

"6thly. That where, in ornament, the leading forms are geometrically disposed, as in regularly recurring scrolls or other curves, which could never take so formal a position in nature, a rendering of her spirit, though not of

her substance, may be permitted in the leaves and accessories. Thus, in much of the elaborate wood-carving produced by Mr. Rogers and others, the artificial disposition alone of the beautifully executed objects redeemed many of the groups from the charge of too close a reproduction of nature.

"Before proceeding to the subject of sculpture, we would fain offer one or two remarks concerning what is called style in art, for fear lest our recommendations to systematic study of elementary principles should be misapprehended. In what are generally understood as styles in the history of art, such as the Grecian, the Roman, the Gothic, the Renaissance, &c., may be recognised deeply-interesting accumulations of experience concerning the nature of men's intuitive affections for certain concatenations of form. Styles are usually complete in themselves; and though not of uniform excellence, are still generally concordant among all the various members that compose them. Whatever may have been the dominant form in each, or whatever the favourite set of ratios, proportion usually pervades each whole monument, as it may be generally traced in a few detached mouldings. Styles, therefore, may be regarded as storehouses of experiments tried, and results ascertained, concerning various methods of conventionalizing, from whence the designer of the present day may learn the general expression to be obtained, by modifying his imitations of nature on the basis of recorded experience, instead of his own wayward impulses alone. Canova, Gibson, and many of the greatest masters in art, held and hold the creed, that nature, as developed in the human form, can only be rightly appreciated by constant recurrence to, and comparison with, the conventionalities of the ancient sculpture of Greece. Mr. Penrose has shown us what beautiful illustrations of optical corrections in line may be gathered from the study of her architectural remains. Mr. Dyce, who has made himself deeply acquainted with ancient styles, thus expresses himself on the subject:—'In the first place,' he remarks, 'the beau-

ties of form or of colour, abstracted from nature by the ornamentist, from the very circumstance that they are abstractions, assume in relation to the whole progress of the art the character of principles or facts, that tend, by accumulation, to bring it to perfection. The accumulated labours of each successive race of ornamentists are so many discoveries made—so many facts to be learned, treasured up, applied to a new use, submitted to the process of artistic generalization, or added to. A language and a literature of ornamental design are constituted; the former of which must be mastered before the latter can be understood; and the latter known before we are in a condition to add to its treasures. The first step, therefore, in the education of ornamentists, must be their initiation into the current and conventional language of their art, and by this means into its existing literature.' By this last passage, we may fairly assume that Mr. Dyce would recommend, first the study of the conventionalities of the student's speciality, and then as much as life is long enough to learn. The great previous error in art-education has been to grasp at so much vaguely, and attain so little practically.

"The modifications which nature receives at the hands of the intelligent sculptor are so various, and frequently so subtle, that it would require a volume to enumerate them, and an Eastlake to write it. We can glance but at a very few. The first condition of the highest class of sculpture is, that it should be allied with the noblest architecture, to which it should serve as an inscription, explaining to those capable of reading its ideal expression those purposes of the structure which it is not in the power of architecture alone to convey. In all such cases *fitness* prescribes the subject—*simplicity*, its sublimest treatment—*contrast*, the general condition of the lines of its composition. In order to give to his works that commanding language which speaks to the heart (the phonetic quality in Mr. Fergusson's admirable theory of beauty in art), the sculptor requires to select from his observation

of the expression of individual forms, those precise lines, which, he learns from study and experience, invariably convey the particular sensations it is his office to communicate to the mind of the beholder. It is by some such process that an approach was made by the Greek sculptors of old to attain an embodiment of their conceptions of divinity, and the *beau idéal* in loveliness of form.

"The peculiar refinements of form and texture which fall within the especial province of the sculptor to carry to their highest pitch of perfection, he constantly heightens by availing himself of the effect on the senses of the simultaneous contrast of form. Thus he exaggerates the roughness of the hair and the coarse texture of every object coming in contact with his flesh, in order to give to it the exquisite smoothness of nature; he introduces straight lines, equally balanced folds, and angular breaks into his draperies, in order to bring out the tender sweeping curves of the outlines of the limbs he so gracefully disposes. His is, of a truth, the happy art which begins by collecting all that is most sweet and fresh; and then by one additional touch, one further artful contrast, he 'throws a perfume on the violet.' In sculpture, as in every other of the decorative arts, changing circumstances bring ever-changing conventionalities; and, as supreme arbiters over the propriety of one and all, still preside our original great principles—*variety, fitness, simplicity, and contrast.*"

END OF VOL. III.

THE

GREAT EXHIBITION

ILLUSTRATED

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